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SOUTH AMERICA: AN OUTLINE OF ITS PHYSICAL GEOGRAPHY.*

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The physical features of South America have had such a marked influence upon its commercial development that a general knowledge of them is of primary importance to any student of its history.

The contrast between North and South America is remarkable: Nature was in her kindest mood when she created the former—gave it vast and fertile plains; low and readily transitable mountain ranges; extensive systems of navigable lakes and rivers, the latter not too difficult to bridge; great forests of the most useful timber; immense mineral wealth, including an abundance of coal and iron; a coast-line offering numerous excellent harbours easily accessible from the interior; and a temperate, inviting climate over almost its whole area. It is a land where man seems to live with nature on friendly terms, and where the wave of humanity, as it rolls westward, encounters no obstacle which it cannot readily overcome. How opposite to all this is South America! It lies mostly within the tropics; its fertile plains, except those of the Argentine Republic, are difficult of access; it is a formidable task to scale and cross its mountain ranges; its rivers, with rare exceptions, are of violent flow and full of obstacles to navigation, and its largest ones not within the limit of practical engineering to bridge; its

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vast forests are hard to work and frequently impenetrable; its mineral wealth, immense in nobler metals, includes but little coal and iron; its coast has but few good harbours, and these are almost all mountain-locked; its climate, although in many parts delightful, is uninviting over extensive regions; the forces of nature are so vigorous that man can seldom count upon the unqualified control of them, and, in general, they confer generous reward only upon well-applied and persistent energy.

THE ANDES.*—If from the most western point of Peru, near Payta, a straight line be drawn as far south as the western entrance to the Straits of Magellan, it will be found that the Pacific coast, at lat. 18° 30',† near Arica, is 500 miles distant at a right angle to that line. The Andes here are also 500 miles in breadth. It seems as if some mighty force had pushed them eastward when they were in a plastic state. They are massed into that complex system of mountains, ridges, parallel, transverse, and interlaced, isolated peaks and volcanic cones, which lie between lat. 14° 30′ and 22° 30′. They form the *massif* of the Andes, the general level of which is much higher than any other equal area of the New World, its plateaux ranging from 12,000 to 14,000 feet elevation. The Bolivian portion alone has thirty-two peaks above 17,000 feet in altitude, including the grand domes of Choroloque (18,450 feet), Guadalupe (18,870), Todos los Santos (19,382), Lipez (19,650), Sajama (21,000), Illampu (the "resplendent" in the Aymara tongue) (21,275), and Illimani (21,190).

THE MASSIF.—I roughly estimate that this most bulky section of the Andes—the *massif*, 500 miles wide from east to west—contains about 487,000 cubic miles of rocky material above sea-level; and, were it spread out to an average height of 378 feet, would make an area equal to that of the whole of South America, say 6,798,000 square miles. Thus we may partially comprehend what physical changes the denudation and erosion of such a range of mountains is capable of producing. Stretching its arms to the north and south, this Andean *massif* spans with them a sixth part of the circumference of our globe, from the Caribbean sea to Cape Horn; and, for the entire distance, there is not a break, from side to side, save where several streams, which rise in the Patagonian plains of the Argentine Republic, find their way through the Cordillera to the Pacific ocean.

The *massif* is a titanic barrier, formidable to scale, as I have often found. On its broad and bleak plateaux, cradled between the Cordillera and the inland Andes, the Incas, imitating nature, also focused their

* See map of South America, p, 460.

† All latitudes herein mentioned are south, and all elevations are in English feet and dated from sea-level, unless otherwise stated. I shall use the word *Cordillera* to represent the single chain or cord, the long main ridge or *Cordillera of the Andes*, the continuous backbone of the continent, and shall not apply the term *Cordillera* to the inland range of the Andes or to any of its numerous ramifications. All "miles" are English statute miles.

empire, and stretched their powerful arms along the mountains over more than 40° of latitude.

From the *massif*, the Andes lose in bulk towards the north and towards the south, although at times some monarch dome, like Chimborazo or Aconcagua, climbs, from a vast base, to indisputable pre-eminence. The height of the passes between 7° 45′ and 37° lat. shows how nature has forbidden their transit, except under almost insurmountable difficulties, and how only a small fraction of the trade of South America can take place from the Pacific side. This is confirmed by the continental drainage, 89 per cent. of which finds its way to the Atlantic ocean, and only 6 to the Pacific; 5 per cent. being absorbed by the thirsty inter-Andean section and the western part of the Argentine Republic.

Passes.—The lowest pass of the coast Cordillera between lat. 23° and 27° is 13,911 feet, and 12,000 feet between lat. 27° and 32°. Then in lat. 32° 33′ is the Uspallata pass, commonly called "La Cumbre," above which towers the superb cone of Aconcagua. This is the historic pass of Spanish colonial days, across which commerce was extensively carried on between the Captain-Generalcy of Chile and the Plata provinces. Its elevation is 11,512 feet. The next low pass is the Planchon, near 36° lat., about 10,000 feet elevation; thence the passes rapidly become lower, until, at 40° 30′ lat., we find the Nahuel Huapi gap only 4920 feet above the sea.

Between lat. 23° and 35°, they are blocked by snow from May to August, or swept by violent storms, especially throughout the forbidding, barren, dry, saline, desert region of south-west Bolivia, north-east Chile, and north-west Argentine Republic, called the *Puna*, which has an elevation of from 11,500 to 13,500 feet. This *puna* region, which in Quichua means a lofty district, is much broken and diversified, and shows many volcanic peaks. Diagonal ridges occasionally connect the two main, snow-crested ranges, between which rise hundreds of lofty mountains, having their drainage into saline plains and depressions which lose their waters with extreme rapidity, solely by evaporation.

From its inland side, the Andean *massif* sends to the southward a vast, broad, netted belt of ridges which forms the western boundary of the Argentine Chaco. They find their most prominent grouping in and round the Sierra de Aconquija, which raises its culminating point to a height estimated at 17,720 feet. The belt, however, shows many other peaks of marked prominence, but it gradually narrows and grows lower until completely broken through by the enormous Salina Grande. It afterwards reappears in the Sierra de Cordoba, the most southern spur of which is about lat. 33°.

Inland Chain.—The true inland range of the Andes, south of 18°, commences near Santa Cruz de la Sierra, in Bolivia, takes a south-south west course, is twice broken through by the headwaters of the Pilcomayo

river, again rises to an imposing height near Tarija, which lies on its south-eastern slope; then, in a much broken, deeply carved, ragged, and confused chain of sierras, sometimes in line and then again echeloned, continues as far as the Sierra de la Huerta, in the Argentine province of San Juan; but, after breaking down there, it rises again in the hills of Pencoso, in the province of San Luis, which may be said to be the last trace of the inland range. Many of its peaks rise to a great altitude, and the splendid dome of Famatina, crowning one of its grand counterforts in the Argentine province of La Rioja, reaches 20,680 feet. Broadly, a line drawn from Santa Cruz de la Sierra to the peak of Aconcagua defines the eastern boundary of the great tableland of the Andes, on the western side of which lies the main Cordillera.

The whole belt of country, 250 to 300 miles wide, which lies between the Pacific ocean and the Gran Chaco, is a barren, almost waterless wilderness, "An extraordinary parallelism exists between the numerous lines of sierras, mostly running north and south, which fill the space. Between them, are deep, scooped-out depressions, sometimes containing salt lagoons. On rare occasions of violent storms, these receive torrential streams from channels which ordinarily carry but little water, and many of which are dry for most of the year. The entire district appears to be a southern prolongation of the Titicaca basin, and possibly may have been so before the Andes reached their present elevation. As it extends southward, it grows lower and less broken, and the *salinas* occupy a larger area, until, to the west and north-west of the Sierra de Cordoba, they are of enormous extent." *

In all the primary and secondary southern offshoots from the Andean *massif* are found volcanic cones, isolated or in groups. The principal summits are numerous; more than thirty are from 17,000 to 20,000 feet high, and Aconcagua lifts its crown to an elevation of 23,080 feet.

South of about 33°, the orographic character of South America undergoes a marked change; there is no longer a broad, lofty tableland, rimmed by gigantic mountains on the east and west. On the contrary, the Andean system now seems massed into a single majestic range from Aconcagua to lat. 41° 30′; thence, dipping its feet in the Pacific ocean along the whole western side of Patagonia, it crosses the Straits of Magellan and borders the entire southern coast of Tierra del Fuego, to defend the continent from antarctic storms. From Aconcagua to the Strait of Le Maire, a wide, magnificent belt of snowy domes gives the Andes continuous dignity and definition. There is a bifurcation of the range at about 38° of latitude, which extends south-south-east and loses itself in the Argentine territory of Neuquen.

TARAPACÁ.—Lying between the rivers Camarones and Loa, which

* See my Presidential Address to the Geographical Section of the British Association, 1898, on "Argentine Geography and the Ancient Pampean Sea."

flow into the Pacific ocean, is the desert of Tarapacá, which, with its southern prolongation, the Antofagasta and Atacama desert, forms a part of the arid, sandy, rainless, wilderness belt of South America, extending from about 3° 30′ to 33° lat. It has a width of from 30 to 100 miles as far south as 23°, and then for 10° widens to 200 and 300 miles. The Tarapacá portion contains the most accessible and workable nitrate of soda deposits known. These desert lands are sometimes swept by violent winds, which pile the drifting sands into immense dunes.

A desolate coast range of mountains, about 30 miles wide, rising to an elevation of from 3000 to 6000 feet, runs the entire length of Tarapacá, and separates its bare plateau, over 30 miles across, from a confused outlying foot range of highlands belonging to the Cordillera of the Andes. This plateau, which is from 3000 to 3500 feet above the sea, is covered with sand, salt, nitrate of soda, and salts of borax.

Antofagasta and Atacama also abound in nitrate of soda, and have rich ores of silver and copper; but, in common with Tarapacá, lack potable water. They form an immense inclined plain, sloping from the Cordillera to the coast sierras, and divided into large basins by intersecting mountain spurs running, at times, diagonally north-west from the Cordillera, and again by other spurs projecting south-east from the coast mountains. The deposits of nitrate of soda are found between lat. 24° and 26° 30′, and occasionally at an altitude of 13,000 feet. The low coast range rises boldly from the ocean, and the plateau behind it is reached through gorges extremely laborious and difficult to penetrate.

As if to accentuate to a still greater degree the contrast between the geographical features of that part of South America lying north of Aconcagua and the portion south of it, nature has not only made lat. 33° the southern limit of the great inland Andes, but also the southern boundary of the desert belt of the Pacific coast; for this is here stopped by the transverse mountain barrier of Chacabuco, which separates it from the delightful, healthy, fertile, and well-watered valley in Chile, which, 30 miles wide, lies between the Cordillera and a low mountain range which immediately borders the Pacific coast, and extends as far as lat. 41° 30′. It is one of the fairest, most inviting valleys I have ever looked upon; but, at the degree of latitude last mentioned, it disappears under the sea, and the now broken-down coast sierra is cut into fragments and a multitude of thickly wooded islands as far as the Straits of Magellan. Through the many channels, inlets, and gulfs the ocean finds its way, and breaks ceaselessly against the precipitous and glacier-dotted Cordillera of the Andes, as if it had also determined to tear that into fragments.

In lat. 18° 30′, the eastern foothills of the *massif* are separated by only a narrow gap of about 120 miles from the low Chiquitos sierras belonging to the Brazilian orographic system, some of which, overlooking the Argentine Chaco, and having a southern drainage into the

river Paraguay, form a part of the *divortium aquarum* between the Amazon and Plata valleys.

There is a great bend of the inland Andes, almost at a right angle, at Santa Cruz de la Sierra. From this point, a vast, uninterrupted chain extends north-west as far as northern Perú, a distance of 1500 miles. Its first section, which bounds the Bolivian province of Cochabamba on the north, rapidly increases in height towards the west until it culminates in the Tunari crest, which climbs to above 16,000 feet. This section overlooks the Mojos plains of Bolivia, and, on its Amazon slope, is precipitous and densely forested.

To the west of Tunari, in lat. 17° 30′, and about halfway between it and the Bolivian city of Oruro, commences a broken central range of mountains, with isolated domes and volcanic cones, which extends almost directly south until it again unites with the eastern rim of the Andean tableland at 24° 30′ lat. At times it has neighbouring parallel lines of isolated sierras and peaks for long distances. It separates the upland district of the *massif* into two sections—the western, which is arid and of too great an altitude for the cultivation of cereals; and the eastern, which gradually drops in height until it abuts boldly upon the Bolivian and Argentine Chaco. This eastern section is much eroded by the numerous headwaters of rivers which are tributary to the Mamoré branch of the Madeira, and by others which flow to the Paraguay.

The central range is generally accepted as the main inland Andes; but I am disposed to concede that rank to the more eastern mountains I have described, although by no means so lofty. The central, according to my observation, appears to belong to the vast tableland which here so remarkably broadens to its maximum width. It presents many peaks and domes from 14,000 to 19,000 feet high; and the snow-crowned Lipez rises to an altitude of 19,650 feet. From this peak, the Lipez barrier, cut by lat. 22° 30′ and composed of a confused belt of *cerros* and knotted ridges, crosses the tableland to the west and north-west, and joins the Pacific coast Cordillera, forming the southern boundary of a lacustrine basin which has an area of 106,000 square miles, and which was once the cradle of an enormous lake, the shrunken remains of which are now known as lakes Titicaca and Pampa Aullagas or Poopo. Lake Titicaca is 12,505 feet in altitude, and has an area of about 3300 square miles. Its surplus waters flow south into the small, shallow Poopo by the narrow Desaguadero channel. Poopo has an elevation of 12,136 feet, according to Ruck.

North-west of Tunari, and as far as Chololo (17,625 feet elevation), at the knot of Apolobamba, a direct distance of 270 miles, the inland Andes overlook the Amazon valley with a huge range of crests and peaks, Illimani and Illampu, the twin giants, overtopping them all. I know of no more beautiful sight than to look eastward, across Lake

Titicaca, at that matchless battalion of snow-crested cones, as the morning sun bursts in among them and rolls vast waves of gold and purple mists up their slopes, until their ice-jewelled crowns break forth in resplendent glory.

The much-eroded and forested eastern slope of this range descends abruptly to the plains of the Beni, once a part of the bed of the ancient Mojos lake.

THE PERUVIAN ANDES.—From the lofty peak of Chololo, the great transverse barrier of Vilcanota roughly curves to the north-west and then south-west, and completely crosses the Andean tableland to unite with the coast Cordillera. It divides the lacustrine basin of Titicaca from the headwaters of the Ucayali, which flows north to join the upper Amazon. This barrier, cut by lat. 14° 30′, has been paramount in determining the topographical features of western South America; for, did it not exist, the Titicaca basin would drain to the northward. As it is, this arid area belongs to the southern orographic system of the Andes. At no remote geological period, it was at a much lower elevation, was fertilized by moisture from the ancient Mojos lake and Pampean sea, and sent its abundant drainage into the south-western river system of the present Argentine Republic. The Vilcanota barrier is the northern and the Lipez barrier the southern limit which I have ventured to assign for the Andean *massif*.

From Chololo north-west, the Andes, continuing for a long distance as the Caravaya range, are prolonged to the knot of Cerro de Pasco, and thence, along the east side of the Marañon, to its great bend, where they broaden into a little-known, complex mass of sierras 100 miles wide, round the western and north-western base of which the river has cut a profound cañon. A little north of the Cerro de Pasco, the short distance dividing the inland Andes from the Cordillera is occupied by an irregular group of mountains, which crosses the tableland transversely and unites the two great ranges. In this group is found the most western section of the Amazon, here called the Marañon.

The inland Andes have been terribly eroded and broken down for a long distance by the Paucartambo, Urubamba, and Apurimac affluents of the Ucayali, assisted by their countless torrential tributaries; and at least 15,000 square miles of country north of Cuzco is a wild tangle of ridges and jungle-matted gorges, impracticable to traverse.

The almost unknown region lying between the Ucayali and the Juruá and Purús affluents of the Amazon has been too little, or too roughly, penetrated to ascertain its orographic character; but probably a low range of highlands exists there, which parallels the inland Andes from 6° 30′ to lat. 14°. This range, and the country lying immediately east of it, would afford a fine field for exploration, and is probably rich in gold and forest products, but it has many savage tribes.

The Cordillera, between 7° 45′ and 23° lat., presents a bold escarpment

to the Pacific ocean. It has twenty-eight transitable passes, very few of which are of practical use. They average about 15,350 feet elevation, and the lowest one, about lat. 23°, is 12,983 feet. North of 7° 45′ lat. the passes decrease in height, and the town of Humani, near this parallel, is seated on the crest of the Andes at an altitude of only 7170 feet.

North of 15° lat., the inter-Andean section, as far as the vicinity of Ecuador, is scarcely a tableland. It is a lofty district covered by Andean spurs, isolated mountains, knots, parallel and diagonal ridges, among all of which are many streams that find their way to the Marañon, the Huallaga, and the Ucayali. It is a vast belt of mountainous country, through any portion of which communications are extremely difficult, and which has no overland road whatever connecting it with the Amazon valley east of the Ucayali river, and not even a mule-track worthy of mention which descends the eastern slope of the Andes. This is in marked contrast to the open, transitable plateaux of the Andean *massif*, which have numerous mule-tracks in all directions, several of which descend to the Beni and Mojos districts of the Amazon basin, and others to Chile and the plains of the Argentine Republic.

Along the Pacific side of Peru, the Cordillera is buttressed with spurs and foothills, which rise from the coast belt of desert lands; and sometimes a short, outlying sierra parallels the main chain; the Negra, in the province of Ancachas, being a good example. Around its northern flank, the *rio* de Santa has carved its way to the Pacific ocean, after having excavated a deep valley in the sierra itself, leaving a sharp crest on either side for over 100 miles. Probably this valley was once a lacustrine basin.

The Ecuadorian Andes.—In northern Peru, and on entering Ecuador, the Andes, which are now low and broken down, seem massed in a broad and capricious single chain, which, however, again bifurcates at the *rio* Jubones (3° 30′ lat.), in the province of Loja, and thence the coast Cordillera is continuous to the Colombian frontier; but the inland Andes are composed of groups of mountains, sierras, and volcanoes, the axis of which, however, presents a parallelism with the coast range. Between the two ranges lie several plateaux of varying altitude, 7300 feet at Loja, near the Peruvian border, and the same near the Colombian, but generally having an elevation of from 8000 to 10,000 feet. Most of the population of the country occupy the pleasanter and more productive lower levels. The plateaux are much broken by transverse ranges of low hills and terraces, surrounding and defining eight inter-Andean valleys, three of which force their drainage through the eastern Andes to the river Amazon, and five through the Cordillera to the Pacific ocean, through gorges of great depth and grandeur.

The road cuttings of the tableland and the cañons frequently show thick strata of ash and pumice, interstratified with vegetable earth, being a partial record of the numerous eruptions which have marked the fiery geological history of Ecuador. Among its volcanoes are the terrible Cotopaxi and Sangai, which have desolated a vast extent of country.

From Guayaquil to Quito, across the Chimborazo pass, "we ride in the heart of probably the most volcanic region of the world. Mother earth, even in recent centuries, has been torn and twisted into the wildest forms. Beds, from 10 to 20 feet thick, of fine, fragmentary rock are often exposed where the road cuts through a hill slope. I noticed a single fragment, weighing perhaps 40 tons, which must have been thrown from Cotopazi, 20 miles distant. The highway has deep excavations, often showing successive layers of volcanic material. In one place is a top cap of earth 3 to 6 inches thick, then 12 to 36 inches of pumice, from the size of a pea to that of a pigeon's egg, then 18 inches of earth, then 5 feet of pumice and ash, then about 5 feet of earth, and then, down to a depth of 40 feet below the surface of the cutting, an immense cap of ash and pebbles of pumice. All these beds vary in thickness according to the direction of the wind at the time of their deposit, which, during the eruptions of Cotopaxi, frequently blows with terrific violence. At some points the deposits are light, at others very heavy, and one may thus understand that Cotopaxi could form high hills by its periodic discharges into the vast valleys which it overlooks. The hills which thickly cover the valleys are smooth in appearance. The *tambo* keeper at Machachi says that the last eruption, three years ago, buried the neighbouring country 3 feet in pumice. "It was intensely dark from 9 a.m. to 11 p.m. Cattle, sheep, horses, and birds died in great numbers." *

The volcanic area of Ecuador extends from the border of Colombia to the northern part of the province of Loja, which lies in contact with Peru, and it includes much of the Amazon as well as the Pacific slope. A great number of peaks, from 16,000 to 20,500 feet elevation, are scattered throughout the Ecuadorian Andes, which have probably been as wildly rocked and tossed and rifted by the action of a score of colossal volcanoes as any equal area of the globe.

The Andes, at least within the tropics, are at times a gigantic electric battery, and so highly charged that they are very dangerous to cross. Once, when riding over the Tacora pass, I noticed, for miles, under my iron-shod mule, a continuous discharge of electric flashes from the rocky ground, and the same pyrotechnic display was going on under the mules of my servants. On a subsequent occasion, I observed that certain of the Andean peaks must have magnetic attraction for each

* Extract from Journal of G. E. Church, 1881.

other; for, riding on the Quito plateau, I watched two storms arise simultaneously, one of which centred round the dome of Chimborazo, while the other, 50 miles distant, crowned the summit of Cotopaxi. Blacker and denser grew the frowning clouds, until their artillery opened fire and echo after echo pealed along the line of the Andes. The two angry monarchs had challenged each other to a duel. Suddenly, through the highly electrified atmosphere, Chimborazo shot a hissing bolt straight for Cotopaxi, which in turn launched one at Chimborazo. Then, for perhaps twenty minutes, with a mighty and ceaseless roar, they hurled their well-aimed lightnings at each other, until the battle clouds dispersed and peace smiled again upon their magnificent loneliness.*

The altitude of the Chimborazo pass is 10,417 feet. It is so difficult of transit, especially in the rainy season, that an Italian fellow-traveller remarked to me, as we reached the summit, "No man ought to be condemned to scale it unless he has murdered his father and mother." A fierce blast of wind generally sweeps over it and pelts the traveller with sand and gravel. When I crossed it, my mule found it difficult to keep his feet, and barely escaped being blown over a precipice. My Indian servant told me that "the wrath of the mountain was especially excited by music; and that, even in the calmest day, Chimborazo would launch a hurricane against any one who dared to play a flute or even to whistle along the pass."

South of Chimborazo, and abreast of Guayaquil, is the Chimbo pass, 10,287 feet elevation, and quite as difficult of transit as that of Chimborazo. These are the principal commercial routes between the interior of Ecuador and the outer world; both descend to the Pacific coast, there being no mule-track to reach the Amazon valley except for explorers. There is a rude one connecting with Colombia on the north and Peru on the south, utilized by an occasional traveller or a mule-load of goods, and a similar *possible* one from Loja to Santa Rosa and Machala, near the entrance to the Gulf of Guayaquil, serves for a small traffic.

The inland Andean chain of Ecuador is more massive and continuous than the coast Cordillera. Its volcanoes are also more numerous and formidable, among them being Sangai, Altar, Tunguragua, Cotopaxi, Rumiñahui, Sincholagua, Antisana, Saraurcu, and Cayambé—all igneous vents of such magnitude that, were three or four of them to open fire at once, they could rock the continent. They are more

* Since writing the above, I find that, in a lecture before the Literary Club of Lima, September 20, 1885, Antonio Raimondi said, "In the elevated portion, principally in the Cordillera, during the rainy season, that is from October to May, terrible tempests arise. The snowy range can be compared to an immense electric battery, which in the morning becomes gradually charged with electricity, until two or three o'clock in the afternoon, the hour when the noisy discharges commence."

restless than their neighbours of the coast Cordillera, and in modern times have been the terror of Ecuador. They have spread over their slopes, principally their western ones, many cubic miles of ash, scoria, pumice, and detritus, and the numberless streams which score their flanks transport to the lowlands huge volumes of this material every year.

It is an error to suppose that the Ecuadorian Andes throw great spurs to the east and south-east, for very long distances, between the tributaries of the Amazon; on the contrary, their counterforts are short, and they terminate boldly upon the forested plains, with a few outlying foothills. This is characteristic of the entire mountain border of the Amazon valley, and gives testimony to its ancient lacustrine condition long subsequent to the uplifting of the Andes, to the denudation of which it is largely indebted for its present level. The whole Amazon slope of Ecuador is a densely forested, jungle-tangled, bat and insect-infested region, and uninviting even for the few savage hordes which struggle there for a wretched existence.

Only a very narrow desert belt separates the Cordillera from the Pacific ocean, from the mouth of the Gulf of Guayaquil to lat. 5°. At lat. 3° 30′ is the river Santa Rosa, navigable for barges and small river-steamers to a point about 20 miles from the sea. South of this river, for 2500 miles, there is no Pacific coast stream equally navigable.

The Occidental region of Ecuador, so well and extensively described by Wolf,* is of great interest. There is none similar to it on the Pacific coast of North and South America between the Colombia river and Cape Horn. It is as if some tropical island, in which Nature had lavishly scattered her gifts, had drifted against the base of the Andes and grounded there. It has an area of about 30,000 square miles, and probably, at no very remote geological epoch, consisted of peninsulas and islands, some of which are now hills and ranges of highlands. Occasionally, especially in the central and northern parts, low Andean spurs run westwards towards the ocean. Due to the uplifting of the coast-line and the denudation of the Cordillera, the intervening low areas are now filled with a fine reddish clay-earth of great fertility. In general, these low lands are above flood-line, except in the valleys of the Guayas river system, which are overflowed for several months yearly. The filling-up process is proceeding so rapidly that it threatens to destroy the usefulness of Guayaquil as a port. The whole region is well forested, and offers many valuable woods for shipbuilding and other uses. On the ocean side are several small streams flowing west

* The world owes much to Dr. Teodoro Wolf for his 'Geografia y Geologia del Ecuador,' which represents twenty years of intelligent, active, and poorly paid labours. To a large extent, he has evolved order out of the geographical chaos which has characterized all maps of the country made before his time.

from a north-and-south range of hills, about 2500 feet high, which separates their headwaters from the Esmeraldas and Guayas basins, the former having an area of 8500 square miles, and the latter 14,000. Most of the extensive Guayas network of rivers is now utilized for steam navigation. The Esmeraldas has a bad bar at its mouth, which deprives it of any trade of importance, although, inside, it is navigable for a considerable distance. North of this river, in the vicinity of the ocean, commences an immense plain, which extends into Colombia beyond the *rio* Mira.

To paraphrase Wolf, "The Cerro de Cayambé concludes the long series of volcanoes of the eastern Andes; thence, although still very high and very wide, they continue in smooth and tranquil forms beyond the frontier to the north. Only a few isolated mountains rise upon the broad *páramos*. It is true that the Andes, between Cayambé and lake San Pablo or la Cocha, near Pasto, have been but little studied, and it seems that their long and lofty ramifications, extending among the numerous rivers of their oriental slopes, form a very complicated region. Here are the headwaters of the rivers Azuela, Cófanes (Aguarico), Chunguer, San Miguel, and Guames; but the old maps disagree as to their order and direction."

THE COLOMBIAN ANDES.—Entering southern Colombia, the Andes become so massed that, for a distance of from 30 to 40 miles, the two main ranges are almost, but not entirely, united in a single Cordillera. Here, in the vicinity of the towns of Ipiales and Tuquerres, built at an elevation of about 10,000 feet, rise several peaks, varying in altitude from 13,000 to 16,000 feet. At 2° N. lat. the ranges again grandly assume their separate *rôles*, but the inland one becomes more masterful. Its rocky material is so vast that it throws a huge bastion 50 miles into the Amazon valley, from which a massive and unbroken chain extends north to the Caribbean sea.

The Andean ranges, now three in number, are locally called the "*Occidental*, *Central*, and *Oriental* Cordilleras." The river Atrato separates the first from an outlying, parallel sierra, which borders, and is frequently washed by the waves of, the Pacific ocean, from near Buenaventura, about 4° N. lat., to the Colombian state of Panama. This shore range, known as the Sierra de Baudo, is generally low, its highest peak being only 6000 feet. Its average elevation (Perez)* is from 2600 to 3300 feet, and its lowest depressions 1000 to 1600 feet elevation. In general, it is a pestiferous region, and consists of a chaos of ridges, highlands, and spurs, terribly ravined by torrential rains, thickly forested, and rendered almost impassable by numberless rivers, brooks, and tropical jungles. In the latitude of the Gulf of Uraba, its extensions push into the isthmus of Panama to meet the Costa Rica system of

* 'Geografia Fisica i Politica de los Estados Unidos de Colombia.' Por Felipe Perez.

mountains.* The whole isthmus is forested, and similar in character to the region just described. As far north-west as Puertobelo, a low range of sierras, from 500 to 2700 feet high, borders the Atlantic coast, breaking down, however, at the Chagres river, where the summit, between the two oceans, is only 300 feet elevation; but continuing south-west and west through Veragua, as far as the Costa Rica frontier, the mountains again commence to climb and broaden into a complex and sinuous belt, and, practically, fill the isthmus with knots, hills, spurs, and peaks, rising in their maximum expression to even 7000 feet. West of Montijo bay, a massive counterfort forms the peninsula of Las Palmas, and between that and the bay of Panama, a large knotted and confused group of mountains forms the peninsula of Azuero, with headlands rising to 3000 feet. Throughout the isthmus, there are many *cerros* above 1000 feet in altitude. From its northern slope, 149 short rivers empty into the Atlantic, and from its southern one 326 flow into the Pacific.

The *Occidental* range has a general elevation of 8000 to 9200 feet, and then gradually sinks, until at about 7° N. lat., where the Cerro Paramillo, the highest in the chain, rises to 11,053 feet, it branches into many inferior ridges, which, fan-like, spread themselves over the broad area between the Gulf of Darien and the lower Cauca valley.

The *Central* chain continues northward with numerous terraced counterforts and ramifications and spurs, thrown right and left diagonally into the valleys of the Cauca and Magdalena, but especially into the latter. It develops the same volcanic characteristics as the inland Andes of Ecuador, of which it is the prolongation. Like the *Occidental*, it begins to lose its vigour about 7° N. lat. It then throws out long, low ridges, constantly decreasing in altitude until they break into foothill and outlying elevations, greatly diversifying the country between the lower Cauca and Magdalena rivers.

This range is, throughout, the loftiest of the Colombian Andes, and many snow-peaks and volcanoes give it great majesty. Several domes rise to an elevation of over 16,000 feet, and the superb Nevado del Huila, having an altitude of 18,700 feet, dons a white bonnet which reaches 3000 feet below its crest. About midway of the range, the pass of Quindio (11,400 feet) gives transit between the Cauca and Magdalena valleys.

The *Oriental* range, frequently called the Suma Paz, commencing at the great bastion thrown eastward from the central chain, is, as far as the vicinity of 4° N., a low *divortium aquarum*, separating the upper waters of the Magdalena from those of the Caquetá branch of the Amazon and the Guayabero affluent of the Guaviari. From the above parallel, near which is the imposing snow-peak of Suma Paz (15,777

* See the *Geographical Journal*, July, 1897: 'Costa Rica,' by George Earl Church.

feet), the Andes become higher and more bulky, and broaden to 50 and 100 miles for a distance of 250 miles, as far north as Pamplona. Within this confused, much-broken, and deeply ravined belt lies the historic centre known to the aboriginal inhabitants as Muequeta,* but now called Santa Fé de Bogotá. To the north, the peaks of the chain maintain an altitude of from 11,000 to 11,500 feet, throwing east a great number of ridges, while to the west, at an altitude of above 8000 feet, vast plateaux are found, such as those of Fusagasuga and Bogotá, separated from the Magdalena valley by a secondary range of mountains.

Between the plain of Bogotá and that of Tunja, lying immediately to the north, are the *Paramos*, extending north, east, and west among the high valleys and loftiest plateaux. From profound gorges, separating groups of mountains, the Magdalena river receives a number of affluents. Still further north are peaks above 14,000 feet elevation, and the ice-capped dome of Cocui, or Chita, towers to 19,624 feet, being the loftiest of the *Oriental* Andes.

As regards the remainder of the chain, I quote from Pereira†: "To the north of the *massif* of Cocui, the country, as a whole, should be considered as a grand plateau, cut everywhere by streams tributary to the Magdalena on the west, Lake Maracaibo on the north, and the Orinoco on the east.

"The group of Almorzadero rises to 13,425 feet, on the Mesa Colorada to 13,514 feet; then, to the south of Pamplona, it divides into two branches—one penetrates to the Venezuelan *paramo* of Tama, 13,120 feet elevation; the other extends directly north, throwing right and left numerous counterforts. The Sierra de Ocana, or its *Jurisdicciones*, at certain places descends to 4460 feet, to afterwards rise to 6560 feet; and, for a length of 124 miles, it constitutes the frontier between the state of Magdalena and the republic of Venezuela. In this part of its development, it is known as the Sierra Negra, Valle Dupar, and Perija. It loses itself to the west of the Gulf of Venezuela in the savanas of Goajiros."

The most remarkable mountain group of South America is the volcanic Sierra de Santa Marta—a mighty outpost upon the shore of the Caribbean sea, keeping watch and ward over the northern flank of the Andes. From a base over 5000 square miles in area it raises five magnificent snow-peaks, the highest estimated at over 19,000 feet above sea-level. It is separated from the *Oriental* chain of Colombia by the valley of the *rio* Rancheria, which makes a long curve round the southern and eastern base of the great sierra and discharges into the Caribbean sea.

To the north-east of the Sierra de Santa Marta lies the peninsula

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* 'Essai sur l'Ancien Cundinamarca.' Par H. Ternaux-Compans.

† 'Les Etats-Unis de Colombie.' Par Ricardo S. Pereira.

of Goajiro, over 90 miles long. Its first half is low and diversified by a few hills, the highest of which is 1200 feet; but the remainder is traversed by three wild, chaotic, and desolate mountain ranges nearly parallel with each other, and crossing the peninsula from north-west to south-east. The one skirting the north-east front of the peninsula rises at one point to 2600 feet, while the other two show summits above 2000 feet.

THE COLOMBIAN RIVER SYSTEM.—Flowing into the Pacific ocean are the Mira, the Patia, the Dagua, and the San Juan, having respectively, including their branches, 15, 36, 30, and 140 miles of waters, which may be navigated by craft drawing about 4 or 5 feet; the San Juan has a bar covered by only from 5 to 7 feet of water. The navigable rivers flowing northward into the Caribbean sea are the Atrato and the Magdalena, the latter having a great main branch, the Cauca.

The Atrato has its sources in 5° N. lat., at an elevation of nearly 1100 feet. Reclus says, "Thanks to the heavy rainfall of its basin, it discharges a larger volume in proportion to its extent than any other known watercourse." Perez gives it 158 inches yearly. The upper section has carved for itself a profound bed in the narrow valley which separates the *Occidental* from the Pacific shore range. In conjunction with the San Juan, flowing into the Pacific, it nearly cuts this range loose from the *Occidental* one. The water-divide between the two streams is but 361 feet in altitude (Perez), and alone prevents them from becoming a marine strait connecting the Atlantic and Pacific oceans. No doubt such a strait once existed.

The tremendous volume of sedimentary matter which the Atrato carries to the sea has deeply loaded the upper part of the Gulf of Darien, which every year shows less depth of water. The river delta is a vast morass of soft ooze, through which the Atrato has thirteen outlets, eight of which are navigable for small boats, and the others have but 6 feet of water on their bars, breaking off suddenly from 2 to 12 fathoms. The river was surveyed by Commander Lull, U.S.N., for 160 miles up to the mouth of the Bojaya. For the whole distance the banks are submerged, in the rainy season, to a depth of 3 and 4 feet. Long reaches vary from 500 to 825 yards in width. It often exceeds 60 feet in depth, and never less than 28 in mid-river. Its current is from 2 to 3 knots an hour. Large craft can ascend it as far as Quibdo, 250 miles, where a pass, 6800 feet elevation, connects its valley with that of the Cauca across the *Occidental* Andes.

THE MAGDALENA RIVER, the one great commercial artery of Colombia, is confined between the Central and Oriental chains of the Andes, and reaches the sea after a course of 850 miles from south to north. It rises in the *Paramo* de las Papas, in a small lake called el Buey, situated in 1° 58′ N. lat., at an elevation of 13,000 feet. It soon leaves the *Paramo*, and, in a winding course of about 40 miles, descends 6500 feet, by a

constant succession of cascades and rapids. At lat. 2° 29′ it is joined by the river Suaza, which almost equals it in volume. From this point onward it receives numerous tributaries, the principal of which, from the right, are the Funza, or *rio* Bogotá, the Carare, Sogamoso, and Cesar; and, from the left, the Paez, the Saldañha, La Miel, and the Cauca.

From its junction with the Paez, it becomes a stream of considerable volume. The *rio* Saldañha is about 160 miles long, and can be ascended 60 miles by boats. Just below it, the Magdalena broadens from 600 to 1300 feet, and has an average depth of 10 to 26 feet; but rises 25 feet more in floods. Further on, the current ceases to be so impetuous, the incline of the river being more regular, but it is, at times, narrowed by the escarpments of the mountains which close in upon it, and at Pescadero, near Honda, it breaks into a short series of cascades and rapids. It then flows rapidly northward to its junction with the Nare, near which it is only about 410 feet wide, between rocky hill slopes, and is very deep.

The river Funza lazily meanders across the tableland of Bogotá, sometimes spreading right and left into lagoons and marshes. Reaching the sloping edge of the plateau, it breaks into a cascade through a gap in the hills about 60 feet wide, and then gives a single leap of about 165 feet, forming the narrow but beautiful cataract of Tequendama. The river then rushes through a rugged gorge to join the Magdalena, descending 6000 feet in its short but wild course.

The principal affluent of the Magdalena is the Cauca, which, like the parent stream, rises in the *Paramo* de las Papas. Its course is governed by the Central and Occidental ranges, between which it flows. Very numerous tributaries increase its volume as it runs north-east to enter the Toba channel of the Magdalena, which, in 1868, became the main one. The principal affluent of the Cauca is the Nechi, up to the mouth of which, a distance of about 130 miles, the Cauca offers precarious navigation for large boats or *champanes*, locally so called. This lower stretch of the river winds through a level, swampy plain; but nearly its whole upper course is a roaring torrent, frequently jammed between mountain spurs, and plunging through gorges over reefs, boulders, and fragments of rock torn from its precipitous banks.

Next to the Cauca, the largest tributary of the Magdalena, is the Sogamoso, and just below the junction the main river is 1900 feet wide. The Sogamoso and its branches are similar in character to the upper and middle Cauca—wild torrents leaping violently along, over cascades and reefs, through deep gorges.

The Cesar has a peculiar course. It rises on the slopes of the Sierra de Santa Marta, and flows south by west along the base of the Oriental Andean range until it enters the Magdalena, a few miles above the mouth of the Cauca.

From 7° N. lat. to the sea, the Magdalena has numerous islands, and frequently sends off lateral channels of considerable volume, which, before they again unite into one main river, envelop long areas of lowlands, forming islands many miles in length and breadth, similar to those of the Orinoco or the Amazon. Occasionally it abandons some of its lateral channels, which become closed for a time, or get choked with rafts of floating trees and tangled vegetation, which, after decaying, are swept away by some great flood, the channel being again restored. Many large lagoons and extensive swamps, flooded to considerable depth in the rainy season, are found inland from the river, and are especially numerous to the east of its course. For a distance of 200 miles before entering the sea, the Magdalena is a broad and beautiful sheet of water.

THE DIQUE, so called, is only a natural channel, or *caño*, 64 miles long, connecting the Magdalena river with the bay of Mantunilla, 10° N. lat., just south of the famous city of Cartagena. From the river, the Dique runs north-westerly to the lagoon of la Cruz, receiving, *en route*, the drainage from a number of lateral valleys and connecting the swamps of Palotal, Corcobado and Mantunilla, and thence turns south-west. Its width varies from 200 to 300 feet, but it has been silted up and choked in some places by vegetation, so that parts of it are sometimes dry or contain but a few inches of stagnant water. The Spanish Government sought to clean out this *caño* and make it the channel for the foreign commerce of Columbia; but the funds set aside for the purpose were maladministered, and nothing was accomplished. As regards the value of the river Magdalena as a commercial avenue, there is an upper navigation between Neiva and Honda, an approximate distance of 200 miles, and a lower of 515 miles between Honda and Barranquilla, which is on the left bank, 15 miles above the mouth of the river.*

At Honda, there are reefs and rapids for a distance of 3 miles. Above these, there is no serious obstacle to navigation for a distance of 95 miles, as far as Purificacion. Above that, for an additional 100 miles, boats may navigate drawing 18 inches of water.

Between Barranquilla and the Honda rapids, for the first 240 miles, say up to Badillo, vessels drawing 5 or 6 feet can run at all seasons; but from Badillo to La Dorada, craft drawing over 3 feet cannot run regularly in summer on account of the shifting sandbanks; and from La Dorada to the Honda rapids the navigation is at all times dangerous. Honda has an elevation of 656 feet, Purificacion 1020 feet, and the river port at Neiva 1702 feet.

The Magdalena has two outlets, the Boca de Rio Viejo and the Boca de Ceniza, the latter about 6 miles west of the former, which, 6 miles from

* Report by Francisco J. Cisneros, F.R.G.S. (1878), an eminent civil engineer, recently deceased, who dedicated his life to the development of Colombian enterprises.

the sea, encloses the densely wooded island of Gomez. The principal entrance is the Ceniza, and, on its bar, the soundings vary from 13 to 15 feet. "Within the past ten years, at least 25 per cent. of the sailing vessels that have visited Barranquilla have been lost on the bar, either going in or coming out; a rolling and treacherous sea exists, in which, even in calm weather, it is difficult for an ordinary ship's boat to live. Many lives have been lost in attempting to sound the bar." *

About halfway between the Magdalena and the Gulf of Uraba, or Darien, the little river Sinu finds its way to the Morosquillo gulf. It is navigable for small craft for about 100 miles, and still further for canoes, although access to the river from the sea is difficult.

Pacific Coast Ports of Colombia.—The ports of the Pacific coast of Colombia between Ecuador and Panama are numerous, but, with two or three exceptions, inaccessible from the interior, and therefore they can only serve the thickly forested regions which lie upon the western slopes of the coast mountains. The one port of importance is Buenaventura, lying at the head of the Bahia del Choco, the entrance to which is at 3° 50′ N. lat. I have visited very many of the ports of the Pacific coast, and this one I find the most beautiful of them. It is easy of access from the sea, spacious, and affords ample protection and accommodation for ships of large tonnage. It is of primary importance, but between it and the rich Cauca valley lie the *Occidental* Andes, thus far only crossed by a mule-track.

On the south side of the department of Panama, there are thirty small bays, besides the gulfs of San Miguel, Montijo, and Panama. At the head of the latter, all the transit commerce of the isthmus has centred since the days of the Spanish conquest. The other ports have remained in their primitive loneliness.

Atlantic Ports of Colombia.—On the Atlantic side, between Costa Rica and the Gulf of Uraba, the ports are almost equally numerous, including the great Chiriqui lagoon, San Blas, Caledonia, and Puertobelo; but none of these so favourably situated for easy communication with the Pacific shore as the latter, by the gap of the Chagres river, which has always controlled the position. This stream flows into the Caribbean sea a little to the west of Puertobelo, and, "from its mouth to a point 83 miles west, the shore runs nearly straight, without any sheltered anchorage whatever; and, indeed, without safe landing, except, in native boats under favourable circumstances, at spots known to the coasters and fishermen, for heavy surf breaks continually along the whole shore." †

* 'The Navigation of the Gulf of Mexico and Caribbean Sea.' United States, Hydrographic Office, 1896.

† The coast of Colombia will play such an important *rôle* when, later, I treat of the Commercial History of South America, that I find it necessary to give many details regarding it and its ports, especially the northern ones, to which the size and draft of Spanish ships had to be adapted.

On the Chagres river bar there are 11 feet of water in the dry season, and just outside is the Laja reef, through which there is a narrow entrance (70 yards) having 14 feet of water. "Within the bar, the water deepens from 17 to 20 feet abreast the town, which is 200 yards above the bar. Here is the anchorage for vessels that can enter. When heavy weather threatens from west to north-east, it is better to put to sea or run for Colon or Puertobelo." A little east of the Chagres river is Colon, or Navy bay, which penetrates 3½ miles inland, is 3 miles wide, depth at entrance about 6 fathoms, and 26 to 28 feet at head of the bay at Colon. It is completely exposed to "northers," sometimes of great violence, during November, December, and January.

Colon is situated on a pestilential morass. The rainfall, mostly in the wet season from April to December, averages about 120 inches.

Over this isthmus route to the Pacific, intermittent, yellow, and other malignant fevers prevail.

Between Colon and Puertobelo is the small harbour of Manzanillo, which has a depth of 2 to 4 fathoms. The coast generally between the two points is frequently bordered by mangrove swamps and reefs, and is most dangerous and uninviting.

We now come to Puertobelo, the best harbour within easy distance of the Chagres' pass across the isthmus, and, consequently, the one selected by Spain for her trade with South America. It is enclosed, to the north and south, by hills of from 600 to 1300 feet elevation, which shut out regular breezes. On the east are fever-breeding swamps. A coral reef skirts the southern shore, and the remains of the city and the ruins of the castle of St. Jerónimo are situated on the beach in the south-east corner. On the north shore are the ruins of the castle of San Fernando. The width of the entrance is 1¼ mile, but it soon narrows to half a mile, which is continuous for a mile further up to the head of the bay. The depth gradually decreases to 7 fathoms.

Between Puertobelo and the Gulf of San Blas, there are several small but useless harbours, except that of Nombre de Dios, the entrance to which is skirted by reefs, and the greater part of the interior is also filled with them. Spain abandoned this harbour in favour of Puertobelo.

From Puertobelo to the Gulf of Darien there are also numerous harbours of no commercial importance, and the entire coast-line abounds in reefs, small islands, and dangerous obstacles to navigation.

The isthmus of Panama has had a tragic, if romantic history. Since the days of Balboa, man has been attracted by some evil influence to this fatal strip of land. Here conquest, commercial ambition, and crime have had uncurbed sway, careless of a never-ending record of disaster, dishonour, and death.

There are a number of small, little-used bays and inlets, of local importance only, between the Gulf of Uraba and Cartagena harbour.

The latter is the best port of Colombia on the north coast. It offers ample space and security for large vessels, is about 8 miles in length, from north to south, but is nearly divided in two by the Terra Bomba. The city is at the north end of the harbour. The anchorage, which is 3 miles to the south of it, has not less than 8 fathoms of water, and is reached by a channel not less in depth. The inner harbour has a depth of only 6 feet. The natural canal, the Dique, above described, connects it with the Magdalena river. Cartagena was the great rendezvous for the Spanish galleon fleets, preliminary to holding the Puertobelo fair. Further east, and just before reaching the mouth of the Magdalena river, is the fairly good harbour of Savanilla, recently made available and connected with the port of Barranquilla by the engineer Cisneros.

Snow-line.—The snow-line of the Andes varies according to latitude, breadth, and geological character of the mountain masses, direction of the prevailing winds, coast currents of the ocean, and topographical features of the Atlantic slope of the continent; but, in general, between Panama and northern Patagonia, it ranges from 14,000 to 15,500 feet, and even to 16,500 in parts of Peru. South of northern Patagonia, it rapidly descends, until, in Tierra del Fuego, it is as low as 4900 feet.

On the Titicaca tableland, barley does not ripen, and it may be said that above 10,000 feet elevation the bleak valleys and mountain slopes give no adequate response to the food quest of man; but thirsty nature prodigally rewards irrigation when this is applied to the desert lands of the Pacific slope.

The Venezuelan Andes.—At about 7° N. lat., near Pamplona, the Oriental Andes throw a powerful belt of sierras to the north-east, which, on reaching the state of Carabobo, in Venezuela, bends to the east, and skirts the whole Caribbean sea-frontage of that country as far as the delta of the Orinoco river. The first section is called the Sierra de Merida, the *massif* of which is capped by the Sierra Nevada de Merida, with two grand peaks, one of which is 15,416 feet elevation, and, according to Codazzi, the highest in Venezuela. It is an immense dome in the midst of lofty *páramos* and sierras. South-west and north-west of this *massif* run several very long and imposing main ridges nearly parallel to each other, and between them lie *páramos* of great extent. Throughout the belt are numerous peaks, many of them exceeding an altitude of 13,000 feet.

The *páramos* are arid upland valleys, plateaux, and rocky slopes, having a scanty growth of coarse herbage, mosses, and lichens. They are frequently swept by violent, icy winds and furious storms of cold rain and hail. Travellers dread to cross them, and they are a formidable impediment to trade, especially those lying on the frontiers between Colombia and Venezuela.

The Sierra de Merida terminates on the north-east, at the depression occupied by the headwaters of the Portuguesa branch of the river

Apure between Barquisimeto and Cojedes. Here there is a great bend in the Andean range; it turns eastward and continues directly along the 10th degree of north latitude, having several peaks above 5000 feet elevation; but at the Unare river, which it overlooks with a peak 3400 feet high, the range breaks down almost to sea-level for a distance of 35 miles, as far as the Aragua river, which skirts the western base of the Cumaná group of mountains. Here the Andes reappear again, and dominate the delta of the river Orinoco with forest-covered peaks, rising to 5480 and 6740 feet elevation.

At an average of 35 miles north of the range just described lies the lateral ridge which faces and precipitously rises from the Caribbean sea. It extends from the Golfo Triste east to Punta Galera, the north-east cape of the island of Trinidad. In its geological history, it appears to have been terribly torn and rent, as if, in some cataclysm, the Caribbean sea had breached and engulfed it for a length of 140 miles, between Capes Codera and Aragua, leaving in its place a shallow sandy bay, with a low and swampy shore. As the Paria range, it then skirts the Caribbean shore of the peninsula of Paria, preserving a nearly direct line until it reaches the gap called the Bocas de Drago, near which its highest peak rises to 3510 feet. Through this gap the sea connects with the Gulf of Paria, and makes Trinidad an island.

The Caracas section is the highest of this coast chain, its altitude averaging over 5000 feet, about twice that of the inland range; and its principal peaks, Naiguatá and the Silla de Caracas, are 9200 and 8650 feet. Between this chain and the inland range lies the garden of Venezuela, the valley of Aragua, one of the most beautiful in South America. At its western extremity is the famous lake of Valencia, 1410 feet above the sea. Its estimated area is 220 square miles.

The large peninsula lying between the laguna of Maracaibo and the Golfo Triste has its western part bounded by a range of highlands which branches roughly north-west from the Merida chain, and terminates on the north at the Gulf of Venezuela or Maracaibo. The remaining portion is much diversified by groups of hills and low sierras, rarely exceeding 2000 feet elevation. The highest, "Cerro San Luis," 4125 feet, is situated about the middle of the peninsula. All the lands are thistle, cactus, and maguey covered, with exception of a few river-valleys, which are fertile and have considerable vegetation. East of the Gulf of Maracaibo is the mountain mass of Paraguaná, connected with the large peninsula just described by a low ridge of sandhills, about 19 miles long and 3 miles wide, which separates the little-known Gulf of Coro, a branch of the Gulf of Maracaibo, from the Caribbean sea. The peninsula of Paraguaná has an area of about 600 square miles, and rises to an elevation of 2885 feet at its highest point.

The northern, ocean frontage of Venezuela, from the western extremity of the Gulf of Maracaibo to the island of Trinidad, is 720 miles in a direct

line. The gulf is 54 miles wide at its mouth, and it extends inland 100 miles. Its prolongation, the Laguna de Maracaibo, having an area of about 8000 square miles, is, in general, navigable for large ships; but, unfortunately, the bars at the entrance do not permit the safe passage of vessels drawing over 10 feet of water, and this against an outflow current of 4 to 5 miles an hour.

The gulf and the laguna are at the bottom of a great depression, and are surrounded by sierras. Some *páramos*, over 13,000 feet high, have their drainage into these vast sheets of water. The shores are low, bordered frequently by immense swamps, and the slopes of the hills and mountains are extensively and densely wooded.

Ports of Venezuela.—The north coast of Venezuela is deficient in good ports. The principal ones are Puerto Cabello, La Guayra, Carenero, Guanta, and Cumaná. The first is situated at the bottom of the well-named Golfo Triste, in the midst of pestilential mangrove swamps, and the interior of it is difficult for the handling and mooring of ships. Due to English engineering skill and perseverance, a small port, of only 79 acres area, has, under immense difficulties, been constructed at La Guayra, as a shelter against the destructive seas which roll into the roadstead and beat against the mountain wall, behind which, at an altitude of 2880 feet, lies the little valley of Caracas.

Venezuelan Guayana.—South and east of the Orinoco river, and lying between it and the frontier of Brazil and British Guayana, is Venezuelan Guayana, an enormous area of country, almost as unknown as when Sir Walter Raleigh, following previous Spanish expeditions, was lured to search within its boundaries for the fabled lake of Parima and the Dorado king. It is occupied by perhaps 10,000 semi-savages, who still jealously guard their home against the rapacity and ruthless oppression of the Christian. All information regarding its interior is still vague; but it gradually rises to the south-east, more or less in terraces, as far as the irregular sierras which act as the *divortia aquarum* between it and the Amazon valley. Numerous abrupt, isolated highlands, broken ridges, and granitic masses diversify it and determine the tortuous courses of its almost numberless streams. Scattered over it are densely wooded areas and savanas of great fertility. The mythical Lake Parima is probably one of its periodically inundated districts so common to South America. The tangled and sinuous ranges of highlands which push the Orinoco to the greatest distance westward are said to contain summits rising to 6000 and 8000 feet.

The British, Dutch, and French Guayanas.—These aggregate about 272,000 square miles. The first is described as a rough, inclined plain sloping from 800 feet elevation to the sea.* The Caribbean sea-frontage is an alluvial flat extending an average of 30 miles inland, and terminating at a range of sand-dunes. Between

* Brown and Sawkins, 'Geology of British Guiana.'

the Essequibo and Corentyne rivers, no part of the country is over 2000 feet high. West of the Essequibo, it is much diversified by groups of mountains and sierras disposed with extreme irregularity, and is, in general, similar in character to Venezuelan Guayana. Extending southeast, from a point a little above the delta of the Orinoco, is the low sierra Itacuna, which forms the watershed between the Caribbean slope and the Cuyuni river, which parallels the sierra, until, at the junction of the Cuyuni with the Essequibo, the range is broken through by the united force of the two rivers, although it shows itself, in low hills, as far east as the river Demerara.

Two mountain systems cross the middle of the country from west to east, the greater consisting of the Pacarima and Merume belt, which is a continuation of the Parima sierra, and the lesser one the Canuco-Camacuma and Corat, extending from the Takuta river to the Essequibo. Further south is the Acarai range, which is the watershed between the Essequibo, the Corentyne, and the Amazon river-basin. Its greatest elevation does not exceed 2500 feet, its northern base being only 800 feet above the sea. It decreases rapidly in height towards the east. The watershed between the headwaters of the Branco branch of the Negro affluent of the Amazon and branches of the Essequibo and other Guayana streams is, according to Brown and Sawkins, only 350 feet above the sea.

Between the Demerara and Corentyne rivers, to the north of 5° N. lat., are many small savanas; but in the beautifully diversified mountainous district south of the Pacarima range there are others very extensive.

The Essequibo river rises in the Acarai mountains, and is 600 miles long, and the Corentyne has its source in 2° N. lat., at an elevation of 700 feet. Both are continuously obstructed by rapids and falls. The former is navigable for 50 miles up to the first rapids, but dangerous shoals obstruct its mouth; the latter has unobstructed navigation for 7 feet draft of water for 150 miles from the sea.*

The topographical and general features of the three Guayanas in question vary but little. Short ranges of highlands and groups of hills, outlined by numerous ramifications of the watercourses, diversify the middle and northern portions of Dutch and French Guayana. Their rivers, except the Surinam, which may be ascended 100 miles from the sea with 10 feet of water, can be penetrated for only a few miles before meeting with rapids, their upper courses being full of obstructions. They are, like British Guayana, covered with a robust and dense tropical vegetation, only interrupted by openings where the soil is too barren for arboreal growth. Occasionally there are savanas, although few far inland. There are many swamps in the hilly districts, transitable

* Schomburgk.

only in the dry season (September and October). The coast-line of Dutch Guayana is a continuous mangrove swamp, that of French Guayana has an occasional hill. The range of Tumuc-Humac mountains, the two highest peaks of which are 1900 and 2624 feet in altitude, forms the water-parting with the Amazon slope. It has a general elevation, according to Coudreau, of about 1200 to 1600 feet in its western and central division, but decreases in height towards its eastern extremity, where it radiates, in several very low broken ridges, between which the rivers Oyapok,* Cachipour, Araguari, and Yari are connected, during the rainy reason, by chains of shallow lakes, not even navigable for canoes. The river Oyapok, which rises in the Tumuc-Humac mountains, flows north-east into the ocean at 4° N. lat. Almost mingling its head-waters with those of the Oyapok is the Brazilian river Araguay, flowing south-east to the sea, which it enters near 1° N. lat. Within the triangle thus formed by these two rivers and the Atlantic coast is an area of about 30,000 square miles, wild and almost unoccupied, but having a better climate and covered with more beautiful savanas than can be found anywhere in French Guayana.†

The three Guayanas (British, Dutch, and French) seem to form a region apart from the remainder of South America, and not linked to its general commercial development by inter-State trade. Their settlement and progress must be slow and difficult. They can offer no avenues by which to reach the heart of the continent. They have all been more or less explored, and, in the remote future, their fertile portions may become utilized for an extensive growth of tropical products.

North-Eastern Brazil.—From the Amazon river to Cape San Roque, the north-east point of Brazil, we have a dry, hot, low, sandy sea-coast belt, poorly watered and with scanty vegetation; but, penetrating inland, it is diversified by *campos*, alluvial flats, and broken hills. The highland range of Ybiapaba, which bounds Ceará on the west, has a steep and often precipitous front to the east. It is 2000 to 2400 feet above sea-level, and flat-topped for a width of 32 to 56 miles. Its western slope is easier towards the *rio* Parnahyba. There are occasional forest areas, but generally the country is thinly wooded, and has extensive intermediate areas of porous, sandy soil covered with grass and scrub. Pasture lands are found on the plateaux and sometimes in the river valleys. The whole enormous area east of the Parnahyba and as far south as 14° of latitude is subject to terrible and prolonged droughts, resulting in starvation to its population, more especially in the state of Ceará. West of the Parnahyba, as far as the river

* By a recent award, the Swiss Government has decided the boundary question submitted to it by France and Brazil, and fixed the Oyapok river from its mouth to its source, and the line of the watershed in the Tumuc-Humac mountains, from the source of the Oyapok to the Dutch frontier, as the boundary-line between French Guayana and Brazil.

† Henri Coudreau, 'Dix ans de Guayane.'

Tocantins, there are dense forests. From the former stream to the mouth of the *rio* São Francisco, the coast is fronted by narrow reefs, mostly coralline, which are usually exposed at low water.

River Parnahyba.—The Parnahyba is the most important river to the east of the Tocantins for a distance of a thousand miles. Its length is about 850 miles, and its general course north-north-east. Its drainage basin has an area of 133,500 square miles. The main tributaries of the Parnahyba rise in the highlands of Mangabeiras, Gurgueia, Piauhy, and Dos Irmãos, the easy slopes of which have their southern drainage into the great river São Francisco and its Preto branch. Although it flows through a low, swampy and unhealthy valley, and has a shallow bed, and is difficult to navigate, still, the Parnahyba and its many branches offer hundreds of miles of navigable waters for craft of light draft. Near its mouth, the river bifurcates, and then, through an enormous and low-lying delta, finds its way into the sea through many canals and channels.

Rio São Francisco.—From about 150 miles north-west of Rio de Janeiro, and almost in contact with the headwaters of the Paraná branch of the Plata, the river São Francisco finds its course of 1800 miles to the sea, which it enters over a shallow bar. It is claimed that its lowest 135 miles are navigable, as also 800 miles of its upper stretches, the remainder being obstructed by great falls and rapids. The Brazilian engineers give the entire river system 4000 miles of navigable lengths. The river flows in a broad valley with table-land bluffs on either side. Sometimes these approach it, but more frequently are from 10 to 20 miles distant. "Forests border the immediate banks, behind which are lower levels of lagoons accompanying the river on its course; they vary in width from a few yards to a few miles, and often extend to the foot of the slopes of the tableland. The greater part of the lowland of the valley, where not swampy, is covered with a dwarfed, scrubby vegetation and tracts of grass lands, with occasional small extents of forest." *

For three-fourths of its course, the São Francisco forms a part of the western boundary of the high maritime tableland and mountain belt of Brazil, which extends from 5° to 30° lat. The coast, nearly throughout, shows a strip of lowlands backed by steep, irregular, and occasionally broken ranges of highlands from 2000 to 4000 feet high. From their gorges and through their foothills numerous short streams find their torrential road to the sea; but many large rivers, such as the Itapicura, Paraguassú, Jaquitinhona, Parahyba, and others in common with the main example, the São Francisco, have cut their way for several hundred miles directly or diagonally across the ranges.

Mountainous Belt of Eastern Brazil.—From Cape São Roque to the

* *Proceedings of the Royal Geographical Society*, June, 1886: "A Sketch of the Physical Geography of Brazil," by James W. Wells.

vicinity of Ouro Preto the broad backbone of the maritime belt, a continuous plateau, varying in width and gradually increasing in altitude, is carved by the rivers into myriad forms. Its general course is south-west, and it is from 100 to 200 miles inland. Near Ouro Preto it merges into the great Serra da Mantequeira, the highest in Brazil. Its main peak, west of Rio de Janeiro, and 60 miles from the sea, is called Itatiaia-assu, and is 10,040 feet altitude. The range extends south-west, and, reaching the state of São Paulo, joins the Serra do Mar. The latter extends from Cape Frio to the state of Rio Grande do Sul, where it turns inland, crosses the state, and, making a grand curve to the west and north-west, connects, through a hilly section of country, with the Caa-guazú "Cordillera" of Paraguay, but *en route* it is broken through by the Uruguay and Paraná rivers.

Round the magnificent bay of Rio de Janeiro, the rocky range of the Serra do Mar culminates in the Serra dos Orgãos, between which and the Serra da Mantequeira the forested mountains are grouped in wild confusion, presenting some of the most beautiful scenery in the world.

In the states of São Paulo, Paraná, Santa Catharina, and Rio Grande do Sul, the country, from an elevation of 2500 to 3000 feet along the western drainage shed of the Serra do Mar, slopes towards the Paraná and Uruguay rivers. It forms a part of the Plata valley, and is deeply scored by these streams and their tributaries, which are all more or less obstructed by falls and rapids. It is a vast undulating tableland, extensively forested in the river valleys with fine cabinet woods, especially in the state of Santa Catharina. Towards the north the woodlands thin out, but abound in cedar and pine, the latter being found as far north as 22° lat. Here and there are immense scrub-covered and grassy plains, which offer excellent pasturage. The whole region is the finest in Brazil, and abounds in mineral and forest wealth, pastoral and agricultural possibilities.

The Serra do Mar, after turning inland in Rio Grande do Sul, is divided midway by a north and south range, which, under the name of the Cuchillo Grande, extends into Uruguay, and forms the water-divide between streams some of which flow west to the Uruguay river, and others east to the Atlantic ocean.

URUGUAY.—Uruguay is traversed by numerous, rounded, radiating ridges of very low hills with easy slopes, also called *cuchillos;* but, in the northern part of the state, these occasionally rise to the dignity of highlands, and reach a maximum elevation of 2000 feet. The southern and western half of the state lies from 150 to 300 feet above sea-level. The whole country is covered with a cap of rich, argillaceous earth, and is unquestionably one of the garden spots of South America.

PARAGUAY.—Paraguay, from north to south, has an inland ridge, the "Cordillera de Caa-Guazú," which is a prolongation of the Sierra

Amambay, its north-eastern boundary. From the junction of these two ranges commences the Sierra Mbaracayú, which pushes eastwards, and, crossing the Paraná river at the great falls of Guayra (about 24° lat.), continues, in a low range of hills, in a sinuous course south-east to the Serra do Mar, passing *en route* through the states of Paraná and Santa Catharina.

Part of Paraguay belongs to the valley of the Paraguay river, and part to that of the Paraná. None of its mountain summits exceeds 3000 to 3500 feet altitude. Immense areas of it are covered to a considerable depth by a fertile red earth, representing the decomposition of the sandstone hills.

East and north are trackless virgin forests, but the remaining part of the state is easily transitable by the few roads which have been cut through the bush and smaller forest growth. The river Paraguay and its branches are the principal commercial avenues.

Argentine South-Eastern Coast.—South of the estuary of La Plata is Cape San Antonio, from which a broad belt of sand-dunes fronts the entire coast-line of the Argentine province of Buenos Ayres, and extends as far as the mouth of the *rio* Negro; but it is interrupted by Bahia Blanca and the neighbouring *rio* Colorado, the former offering the only port for the entire distance of about 600 miles. Thirty miles north of the estuary of Bahia Blanca, and parallel to it, is a short, isolated range of mountains, the Ventana and Curamalal, the highest peak of which is 3536 feet elevation, according to my own instrumental measurement.

Atlantic Coast Ports.—On the Atlantic side, from the straits of Magellan north, we have, as far as Bahia Blanca, but few good and well-sheltered ports, and the conflicting tides, currents, and winds, added to the dangers from reefs and shoals, make them difficult of access. Bahia Blanca is, however, a harbour easy to enter, spacious and well-protected, and its port is the natural outlet of a vast area of the Argentine Republic. Then follow the river ports Rosario, Buenos Ayres, and Montevideo, the great emporiums of the Plata valley; then Santos and the magnificent, perhaps matchless, bay of Rio de Janeiro; and next Bahia de San Salvador, a great, safe, deep harbour of easy access; then comes the roadstead of Pernambuco, with its interior harbour for small ships, behind a reef; and, finally, the great and excellent river port of Pará, which largely controls the development of the Amazon valley. Besides these, there are many secondary harbours and ports between the mouth of the Amazon and the Rio de la Plata, which increasing commerce will bring into prominence.

Pacific Coast Ports.—The west coast of South America, from the Straits of Magellan to Valdivia, has a great number of useful inlets and bays suited to its very limited commercial requirements; but from lat. 40° to Panama almost all the ports are roadsteads, either wholly or partially exposed to the direct action of the ocean, save a few principal

harbours, such as the spacious and beautiful ones of Valdivia and Talcahuano, the good ports of Lota and Coronel in Arauco bay, the semi-circular one of Valparaiso, exposed to the north, the well-sheltered, large Coquimbo, the somewhat open Caldera, the good port of Taltal, the large but inferior Mejillones, the well-protected and excellent bay of Callao—the best on the Pacific coast of South America—and the very good port of Guayaquil, which, with the ones north of it, have already been mentioned.

I have shown that the marginal belt of South America has, on its western side, an almost impassable rocky barrier; precipitous mountains on the Caribbean sea frontage; broken ranges in all the Guayanas, forbidding easy communication inland; rampart after rampart of highlands and tablelands in Brazil, from Maranhão to Rio Grande do Norte; and thence southward, a steep frontage of highlands in the northern part, and a rocky escarpment the whole length of the Serra do Mar; and, finally, immediately south of the Plata estuary, a broad belt of sand-dunes without a port until Bahia Blanca is reached.

The Great Commercial Doorways of South America.—What breaks are there in this mountain-fringed continent which offer access to its magnificent interior? Four only: the river Orinoco, the Amazon, the Rio de la Plata, and Bahia Blanca. Of these natural doorways, one belongs to Venezuela, one to Brazil, and two to the Argentine Republic. The ports of Patagonia have relation to Patagonia alone.

The Orinoco, the Amazon, and Plata basins occupy 0·63 (nearly two-thirds) of the continental area. It should, however, be noted that, according to Dr. Bludeau, the united basins of the twin rivers Colorado and Negro of the Argentine Republic have an area 99,500 square miles larger than the valley of the Orinoco, which has 364,500. The Amazon has, if we include the Tocantins, 2,722,000, and the Plata, 1,198,000 square miles. The important secondary basins of South America are the Magdalena, 102,500 square miles; the Parnahyba, 133,500, and the São Francisco, 251,500 square miles. The maritime tract between the Orinoco and the Amazon, including the river-basins of British, Dutch, and French Guayana, has a drainage area of 190,500 square miles; that between the Magdalena and Orinoco, including the Laguna de Maracaibo, 94,500.

The Orinoco and its Basin.—I have referred to the highland district of Venezuelan Guayana, along the western and northern boundary of which the Orinoco finds its way to the sea. There is no more interesting field in South America awaiting exploration. In this region, we have the unknown sources of the Orinoco, which drain the north-western slopes of the Parima range of highlands. In 1857, Michelena y Rojas ascended the Orinoco about 170 miles above its Casiquiare junction to the *rio* Mawaca, and then a few miles up this stream. Beyond these points, the only information we have is that communicated by the

Indians to de la Fuente in 1759, and de Mendoza in 1764, and the subsequent, vague statements of Humboldt regarding the district.

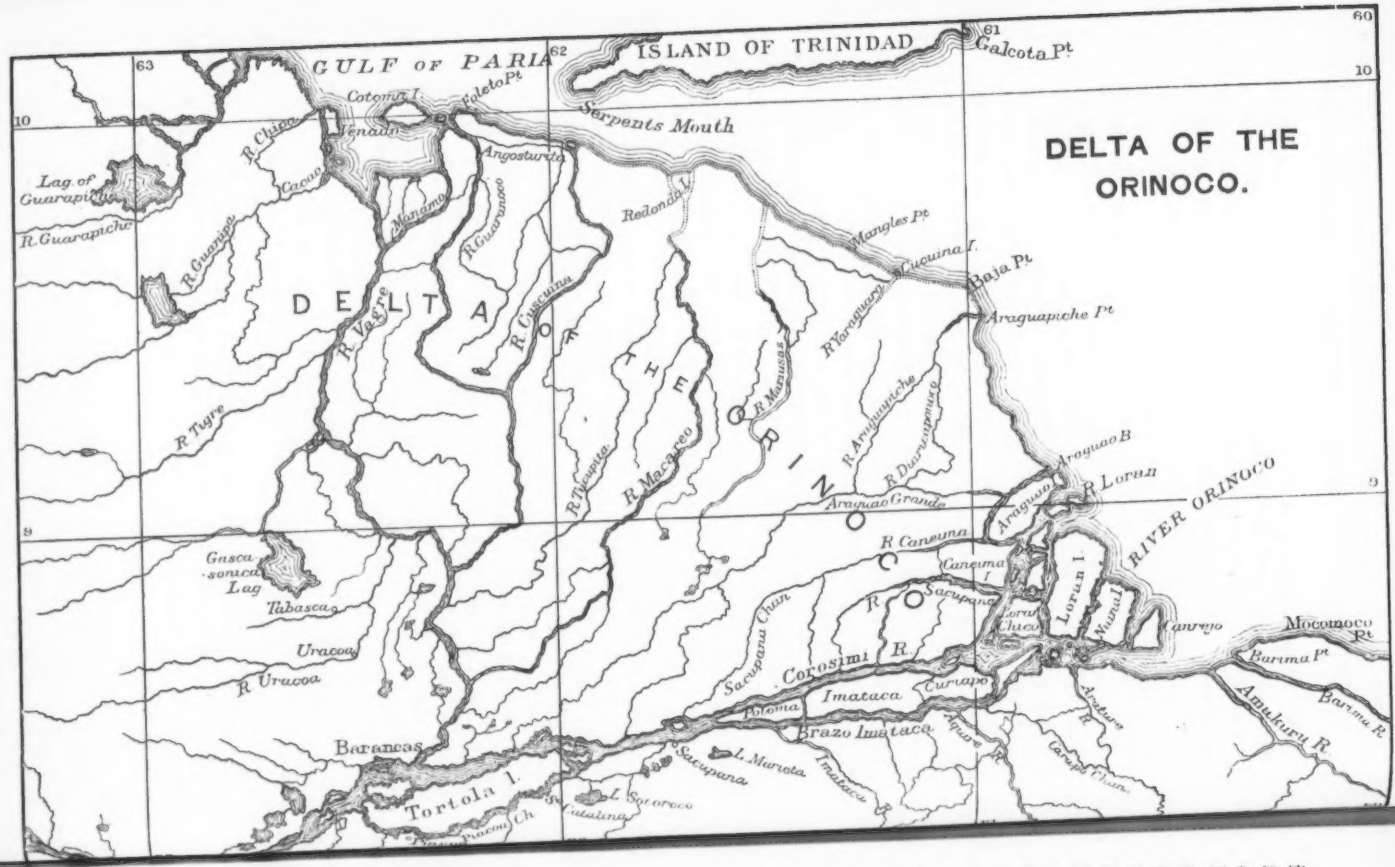
The Orinoco, as far as its junction with the Guaviari, has, in general, a north-west course, and 90 miles before its union with that stream it receives its principal eastern affluent, the Ventuari, which has its unexplored sources in the interior of Venezuelan Guayana.

From the Guaviari, the Orinoco runs nearly north as far as the Apure, where it suddenly takes an eastern course to the sea, receiving *en route*, from the right, the large rivers Caura and Caroni, the latter having a course of about 800 miles, of which 400 miles are navigable.

Between the Guaviari and the Meta, the Orinoco is obstructed by the famous Maipures cataract, where, in several channels, it breaks through a granitic spur of the Guayana highlands for a length of about 4 miles, with a total fall of about 40 feet, and, then, after passing two minor reefs, reaches the Atures rapids, where it plunges through a succession of gorges, for a distance of about 6 miles, winding among confused masses of granite boulders, and falling about 30 feet. It has free navigation for about 700 miles, up to the *raudal* or rapid of Cariben, within 6 miles of the mouth of the Meta, where it is about a mile wide. Thence it gradually broadens, as it continues north, until, at the mouth of the Apure, it is over 2 miles wide in the dry season, and about 7 miles in floods. At Cariben it rises 32 feet, but at the *Angostura*, or narrows, 373 miles from the sea, the flood-line reaches as high as 50 feet above low river, and even attained 60 feet in 1892. The total length of the Orinoco is about 1500 miles, but, if measured by its Guaviari branch, is several hundred miles longer. Like its great rivals in South America, it floods immense areas of country during the wet season, reaching its maximum rise in August. Continuing its eastern course, it enters the sea by its main trunk, the Boca Grande; but, about 100 miles above its mouth, throws a great branch almost directly northward to the Gulf of Paria, a distance also of 100 miles. From the vicinity of this bifurcation, six other considerable arms find their way to the ocean across the vast triangular delta of about 7000 square miles area, which is raised so little above sea-level that much of it is submerged during floods. The delta is covered with a dense vegetation, and cut by a network of *caños* ramifying in all directions among swamps and islands. The Boca Grande is the deepest, and is the main navigable entrance at all seasons, the muddy bar usually maintaining a depth of 16 feet.*

The Apure.—From the Andean slopes, many great rivers, swollen by numberless tributaries, find their way across the plains and add to the volume of the parent stream. The four main ones are the Apure, the Arauca, the Meta, and the Guaviari. The first proceeds from two

* See map of the Delta of the Orinoco, p. 362.


DELTA OF THE ORINOCO.
GULF OF PARIA
ISLAND OF TRINIDAD
Galcota Pt
Cotoma I.
Toledo Pt
Serpents Mouth
Venado
R. Chiro
Lag. of Guarapiche
Cacao
Angosturita
R. Guarapiche
R. Guanipa
Manamo
R. Guarapoco
Redonda I.
Mangles Pt
Cuscuina I.
Baja Pt
Araguapiche Pt
DELTA
R. Vagre
R. Cuscuina
R. Tigre
R. Manamo
R. Macareo
R. Araguao
R. Durumpanse
Araguao B
R. Loran
Araguao Grande
R. Caneuna
Caneuna I.
Gasca sonica Lag
Tibasca
Uracoa
R. Uracoa
Sacupana Chan
Sacupana
Loran I.
Mucural
Mocomoco R.
Barima Pt
Barima R.
Amakuru R.
Corosimi R.
Curiapo
Aboma
Imataca
Brazo Imataca
Aguire R.
Barancas
Sacupana
L. Murieta
Tortola I.
L. Sacoroco
Mutalina
Pacoal Ch.

important streams, the Uribante and Sarare. The former rises in the Sierra de Merida, and has sixteen large affluents; and the latter has its origin near the Colombian city of Pamplona. The Apure is 645 miles long from the junction of these streams to the Orinoco, of which 564 miles are claimed by Codazzi as navigable, although the river has some troublesome rapids 114 miles above its mouth, where it is 3 miles wide. The numerous great tributaries which it receives from the north water the rich and beautiful eastern and southern slopes of the Merida, Caraboso, and Caracas mountains. Some of them are navigable for short distances, and among them the Portuguesa is the most important. It spreads its branches out to the south of Caraboso like a huge fan. It is on the main route between the Caribbean coast and the Venezuelan *llanos*. A few large rivers enter the lower Apure from the south, but they are frequently entangled in lateral canals or *caños*, due to the uniform level of the plains. The waters of the lower Apure, especially during flood-time, have opened a great number of such *caños* before reaching the Orinoco. The plains of the Apure are estimated to have an area of 16,000 square miles.

The Arauca.—South of the Apure, a river of great volume, the Arauca, enters the Orinoco. It rises in the *Oriental* Andes of Colombia, but soon reaches the plain in common with its neighbour, the Sarare affluent of the Apure. This affluent, according to an interesting account given by Perez, has formed a gigantic dam across its own course from the prodigious quantities of trees, bushes, vines, and roots it has torn from its banks, and thus, impounding its own waters, has cut a new channel to the southward across the lowlands and joined the Arauca, from which the Sarare may be reached in small craft and ascended to the vicinity of Pamplona. The Arauca is navigable by large boats and barges up to the Andes, and by sail to its middle course. In floods, unable to carry the additional water contributed by the Sarare, it overflows its banks, and, by several *caños*, gives its surplus to the Capanaparo, which, about 18 miles further south, joins the Orinoco.

The Meta.—Between 4° and 6° 30″ N. lat., the lofty *Oriental* Andes of Colombia seem to seize the moisture-laden trade winds, which, due to the warm lowlands they have previously traversed, have largely escaped condensation, and wring from them their last drop of water. Countless streams unite as they pour down the mountain gorges to cross the *llanos* by a score of broad, deep channels and contribute to the ever-increasing volume of their grand collecting artery, the Meta,* as it flows onward to the Orinoco. In marked contrast to its northern watershed is its southern one, which gives the parent river but a

* In 1783 the Viceroy Archbishop, Caballero y Gongora, caused a map to be made of the course of the Meta and Orinoco to the sea, with a view to open commerce with Bogotá by that route; but the all-dominating power of Cartagena, backed by Santa Marta, destroyed the effort.

few insignificant tributaries from the plains. The Meta is known as such from the union of two Andean streams, the Negro and Humadea, which rise near Bogotá. At their junction, 700 feet above the sea (Perez), it is 1000 feet wide and 7 feet deep in the dry season; but in flood-time it rises 30 feet. About 150 miles of the lower course of the Meta are really navigable, from the mouth up to the old Apostadero. But it may be ascended about 500 miles by launches, in the wet season, to the junction of the Negro with the Humadea. In the dry season, however, it is obstructed, from the Apostadero up, by reefs, sandbanks, shallows, snags, and floating timber and trees, so that navigation even by canoes is difficult, while the savage hordes along its banks add to the dangers to be encountered.

The Guaviari.—The next great, western tributary of the Orinoco is the Guaviari.* Its headwaters almost interlace with those of the Magdalena river of Colombia. Numerous rapids and falls obstruct its upper reaches, and its middle course is not free from them. It is about 500 miles long, of which 300 are called navigable. Its banks are forested throughout. Two-thirds of the way up from its mouth, it receives its Ariari tributary from the north-west, which is navigable for large boats.† The Guaviari is infested by numerous and ferocious alligators, which attack canoes, as Crevaux found while exploring it. I had a similar experience on the Mamoré river, where one of those gigantic saurians fiercely charged my canoe and nearly overturned it in his effort to seize one of my Indian canoemen. Near its mouth the Guaviari receives the large river Ynirida from the south-west. From the great rapid of Mariapiri, 180 miles up, the Ynirida courses swiftly through a rough country, but, for a long distance above that, it is a succession of lakes and shallow overflowed areas. Its headwaters do not reach the Andean foothills.

The famous Casiquiare "canal" unites the upper Orinoco with the *rio* Negro branch of the Amazon. Although travellers in general give it an elevation of from 400 to 900 feet, it probably does not exceed 335 feet above sea-level. It is about 300 miles long, with an average depth of 30 feet,‡ and has a strong current in the direction of the Negro. From its own extensive drainage basin, it receives several rivers of considerable volume, so that, although where it divides from the Orinoco it is only about 220 feet wide, it swells to five times that width

* Crevaux, in common with many geographers and explorers, gives the name of Guayabero to the Guaviari; but Eugenio Alvardo, of the Spanish commission of limits with Brazil, informed the Viceroy of Bogotá, in 1759, that the Ariari and the Guayabero rise between Neiva and Popayan, between 2° 30′ and 3° 30′ N. lat. Both run east; the first turns south to enter the second, and, when it joins the Guayabero, it takes the composite name of Guaviari. In the history and pronunciation of those times, they called it Guaibari, or Guayuare.

† See Crevaux.

‡ Michelena y Rojas, 'Exploracion Oficial.'

before reaching its Negro outlet, thus showing that the quantity of water contributed to it from the Orinoco is small in comparison to what it gathers *en route*. It is not, as generally supposed, a sluggish canal on a flat tableland, but a great river, which, if its upper waters had not found contact with the Orinoco, would belong entirely to the Negro. The expedition of demarcation of limits of Yturriaga y Solano, in 1756, was the first to verify the statement of the missionary explorer, Padre Roman, in 1743, that the Orinoco sent part of its waters to the Negro by the Casiquiare.*

The Llanos.—South of the mountainous district which separates the Caribbean sea from the Orinoco valley, and towards the Orinoco river and its Meta branch, are the *llaños*, having an area of about 200,000 square miles. Probably their present population and products are less than they were four centuries ago. From the edge of the forest-belt, at the foot of the mountains, on the north and north-west, one descends to the true *llaños* by a series of terraces, which are semi-arid, have a gravelly soil, are sometimes rocky, and occasionally cut by deep ravines. These terraces are called the *llaños altos;* but as the Apure river is approached they give place to the *llaños bajos*, which are immense plains abounding in animal-life. They extend south beyond the Meta. Scattered over them are great savanas, dotted at times with groves and thickets, swamps and fresh-water lagoons, and an occasional slight prominence in an apparently unlimited sea of grassy pampa. Tens of thousands of square miles of this region are yearly inundated and enriched by the rivers which overflow their banks. Like the Beni and Mojos plain of Bolivia, it seems an unfinished country, the mountains not yet having sent enough material to the *llaños* to keep them out of water during the entire year. It is a land of extremes, the wet season terribly wet, and the dry one intensely dry. During the latter, dreary wastes of dried-up swamps are occasionally met. The upper *llaños* produce a coarse herbage, but the lower ones are rich in a luxurious growth of fine, succulent grasses, especially to the south of the Apure river. The lower *llaños* are healthy during the dry season of about seven months' duration, but, on account of the miasmas, are pestilential for the rest of the year. The marshes are pestiferous at all times.

Vast areas of Venezuela and Colombia are almost as unknown as they

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* A much shorter connection exists to the west of the Casiquiare, between the Orinoco and Amazon basins, by the isthmus of Pimichin. It is reached from the Orinoco river by ascending the Atabapo and its Temi branch. The latter is somewhat obstructed, but could easily be cleared out and made navigable. The isthmus, 10 miles across, has undulations not above 50 feet high, and swamps and marshes. It is much used for the transit of large canoes, which are hauled over it, and thence, by the little river Pimichin, reach the *rio* Negro. A similar portage, only a mile, exists between the upper waters of the Negro and the Essequibo (Wallace, 'Travels on the Amazon and Rio Negro').

were in the early days of the Spanish conquistadores, and the entire country, from British Guiana to the Colombian Andes, and lying south of the Orinoco and its Apure branch, awaits scientific exploration.

The Amazon Valley.—The part of Brazil lying between the three Guayanas and the lower Amazon river, and bounded on the east by the sea, and on the west by the *rio* Negro, is Brazilian Guayana. It is little known, but is dry and uninviting, from the fact that the north-east trade winds are almost wrung dry by the highlands of all the northern Guayanas, and have but little moisture left when they reach the Amazon slope, especially its eastern half. Forests do not appear except in the few river valleys and on their hilly margins. The rolling tablelands are stony and sandy, and covered with coarse grass, scrubby bushes, and groves of stunted trees. Judging from the distance to the Amazon river from the *divortium aquarum* on the north, the slope of the country must be sharper than that on the southern side of the Amazon, and it is perhaps more diversified; groups of table-topped hills, and at times isolated granitic or gneissic peaks, rise abruptly from the broken plains. Two minor streams, full of rapids, descend from the Tumuc-Humac range, the Yary and the Paron, and flow south-east to the Amazon. The highest elevation between their headwaters and those of the Moroni river, of French Guayana, is but 1300 feet, according to Crevaux. Further west, a little above Obidos, the Trombetas river enters the Amazon, its long course from the Guayana highlands being also frequently interrupted by falls and rapids.* The inferior zone of the river, as far up as the first fall, the Porteira, has but little broken water, and is low and swampy, but above the long series of cataracts and rapids, the character and aspect of the valley completely change, and the climate is much better. The river is navigable for 135 miles above its mouth.

All the Guayanas, Venezuelan, British, Dutch, French, and Brazilian, form an island four or five times the size of France. A tortuous, low chain of mountains, running roughly east and west, cuts it into two nearly equal parts: the northern is saturated and river-torn; the southern is, in general, thirsty and semi-barren, and the driest region of the Amazon valley. It is an area of South America which has been left almost in the undisturbed possession of nomadic Indian tribes, whose scanty numbers find it difficult to solve the food problem.

Lying north of the rivers Napo and Amazon, and south of the Guaviari branch of the Orinoco, and between the Negro and the Andes, is another immense region, the greater part of which is still an unexplored wilderness. What little can be learned regarding it is to the

* In the exploration of this river, the intrepid explorer Henri Coudreau has recently lost his life, thus closing a short but remarkable career of devotion to the scientific examination of many of the affluents of the Amazon. A record of his last work, 'Voyage au Trombetas,' was published only in 1899 by O. Coudreau.

effect that it is of but slight elevation above the sea, and but little broken after leaving the foothills of the Colombian Andes, from which it gently slopes to the south-east in terraces. It seems to resemble the *llanos* of Venezuela in topographical features, but is more extensively wooded.

Rio Negro.—This river, the great northern tributary of the Amazon, has its sources along the watershed between the Orinoco and Amazon divide, and also connects with the Orinoco. Its main affluent is the Uaupes, which disputes with the headwaters of the Guaviari the drainage of a section of the eastern slope of the *Oriental* Andes of Colombia. The Negro is navigable for 450 miles above its mouth for 4 feet of water in the dry season, but it has many sandbanks and minor difficulties. In the wet season it overflows the country far and wide, sometimes to a breadth of 20 miles, for long distances; and for 400 miles up, as far as Santa Isabela,* is a succession of lagoons, full of long islands and intricate channels, and the slope of the country is so gentle that the river has almost no current. But just before reaching the Uaupes there is a long series of reefs, over which the river violently flows in rapids, cataracts, and whirlpools. The Uaupes is full of similar obstacles, some fifty rapids barring its navigation, although a considerable stretch of its upper course is said to be free from them, and to gently flow through a forested country. Despite the impediments, canoes can ascend the river to the Andes. San Carlos, near the mouth of the Casiquiare, is estimated by Wallace to be 250 feet above the mouth of the *rio* Negro. After some study of the subject, I think this an excessive estimate. The confluence of the Negro with the Amazon is said to be 85 feet above sea-level.† Probably, this also is too high an estimate.

Rio Branco.—The principal affluent of the Negro from the north is the Branco, which is swollen by many streams from the southern slopes of the sierras which separate the Venezuelan and British Guayanas from Brazil. Its two upper main tributaries are the Uraricuera, from the north-west, and the Takutú, which almost links its upper branches with those of the Essequibo. The Branco, then flowing nearly south, is broken by a series of rapids 235 miles above its mouth. It finds its way into the Negro through several channels and chains of lagoons similar to those of the latter river.

The Yapurá.—West of the Negro, the Amazon receives three more imposing streams from the north-west, the Yapurá, the Içá, or Putumayo, and the Napo. The first was formerly known as the Hyapora, but its Brazilian part is now called the Yapurá, and its Colombian portion the Caquetá. Barão de Marajo gives it 600 miles of

* Wallace, 'The Amazon and Rio Negro.'

† Commander Todd, U.S. Navy, Report on voyage of the U.S. steamer *Wilmington* up the Amazon river, 1899.

navigable stretches; but Crevaux, who descended it, describes it as a frightful river, forests, jungles, rapids, cataracts, torrential rains, cannibals, and fevers throughout its course. It rises in the Colombian Andes, nearly in touch with the sources of the Magdalena, and augments its volume from many branches as it courses through Colombia. It was long supposed to have eight mouths, but Ribeiro de Sampaio, in his voyage of 1774, determined that there was but one real mouth, and that the supposed others are all *furos*, or *caños*. In 1864–68 the Brazilian Government made a somewhat careful examination of the Brazilian part of the river, and as far up as the rapid of Cupaty. Several very easy and almost complete water routes exist between the Yapurá and *rio* Negro across the low, flat, intervening country. Barão de Marajo says there are six of them, and one which connects the upper Yapurá with the Uaupes branch of the Negro; thus the Indian tribes of the respective valleys have facile contact with each other.

The Içá, or Putumayo, west of and parallel to the Yapurá, was found more agreeable to navigate by Crevaux. He ascended it in a steamer drawing 6 feet of water, and running day and night. He reached Cuemby, 800 miles above its mouth, without finding a single rapid. Cuemby is only 200 miles from the Pacific ocean, in a straight line passing through the town of Pasto, in southern Colombia. There was not a stone to be seen up to the base of the Andes; the river-banks were of argillaceous earth, and the bottom of fine sand. Codazzi had previously spent a long period of time among its upper branches. Rafael Reyes descended it in 1874, and the following year three small steamers ascended it.

The Napo.—The Napo rises on the flanks of Antisana, Sincholagua, and Cotopaxi. Before it reaches the plains, it receives a great number of small streams from impenetrable, saturated, and much-broken mountainous districts, where the dense and varied vegetation seems to fight for every square foot of ground. From the north, it is joined by the river Coca, having its sources in the gorges of Cayambé on the equator, and also a powerful river, the Aguarico, having its headwaters between Cayambé and the Colombian frontier. From the west, it receives a secondary tributary, the Curaray, from the Andean slopes between Cotopaxi and Tunguragua.

From its Coca branch to the mouth of the Curaray, the Napo is full of snags and shelving sandbanks, and throws out numerous *caños* forming jungle-tangled islands, which in the wet season are flooded,* giving the river an immense width. From the Coca to the Amazon, it runs through a forested plain, where not a hill is visible from the river, its uniformly level banks being only interrupted by swamps and lagoons.†

* Orton, 'The Andes and the Amazon.'

† Osculati, 'Esplorazione delle Regioni equatoriali.'

All of these Napo tributaries are practically unexplored, and the *conquistadores* and travellers who have penetrated the Amazon valley from Quito by the historic way of the Napo, or its Coca branch, have been too busy battling with the innumerable obstacles they have encountered to pay much attention even to a rude survey of their route. They have not greatly extended the information given to us by Padre Samuel Fritz in 1686, and other missionaries as early as 1605.

From the Amazon, the Napo is navigable for river-craft up to its Curary branch, a distance of about 216 miles, and perhaps a few miles higher; thence, by painful canoe navigation, its upper waters may be ascended as far as Santa Rosa, the usual point of embarkation for any venturesome traveller who descends from the Quito tableland. The Coca river * may be penetrated as far up as its middle course, where it is jammed between two mountain walls in a deep cañon, along which it dashes over high falls and numerous reefs. This is the stream made famous by the expedition of Gonzalo Pizarro.†

The Nanay.—The next tributary of the Amazon west of the Napo is the Nanay. It belongs entirely to the lowlands, and is very crooked, has a slow current, and divides much into *caños* and strings of lagoons which flood the flat, low areas of country on either side. It is simply the drainage ditch of districts which are extensively overflowed in the rainy season. Captain Butt ascended it 195 miles, to near its source.

The Tigre.—The Tigre enters the Amazon west of the Nanay, and is navigable for small vessels for 125 miles. Like the latter stream, it belongs wholly to the plains. Its mouth is 42 miles west of the junction of the Ucayali with the Amazon.‡

* Villavicencio, 'Geografia del Ecuador.'

† Pizarro reached the Coca from Quito, and with incredible hardships marched the remnant of his numerous expedition down the river-bank to a point below the above-mentioned obstructions. Here he built the "bergantin" in which he afterwards sent Orellana down-stream in search of food, who, finding it impossible to return against the violent current, had no alternative but to continue on and be carried to the ocean by the then unknown Amazon. See Augustin de Carate, 'Historia del Descubrimiento y Conquista de las Provincias del Perú.' Sevilla; 1577.

‡ There is a difference among geographers as to the point where the Marañon ends and the Amazon commences, or whether both names apply to the same river. I am disposed to consider the Marañon as terminating at the natural point, the Pongo de Manseriche, at the base of the Andes, where the head of useful navigation ceases. Upon examination of the hydrographic conditions of the great valley, the convenience and accuracy of this may perhaps be generally recognized. Raimondi terminates the Marañon at the mouth of the Ucayali, Reclus the same, both following the early missionary fathers of the colonial period. M. de la Condamine uses "Amazon" and "Marañon" indiscriminately, and considers them one and the same. Smyth and Lowe give the mouth of the Javari as the eastern limit, as does d'Orbigny. Wolf, apparently uncertain, carries the "Marañon or Amazon" to the Peruvian frontier of Brazil at Tabatinga. Other travellers and explorers contribute to the confusion. It probably arises from the rivalry of the Spaniards and Portuguese. The former accepted the name "Marañon" in Peru, and as the missionaries penetrated the valley they extended the name until they reached the Ucayali, while as the Portuguese ascended the Amazon they carried its name to the extent of their explorations.

THE PASTAZA.—Continuing west from the Tigre, we have the Parinari, Chambira, and Nucuray, all short, lowland streams resembling the Nanay in character. We then come to the great river Pastaza. It rises on the Ecuadorian tableland, where a branch from the valley of Riobamba unites with one from the Latacunga basin, and breaks through the inland range of the Andes, and, joined afterwards by several important tributaries, finds its way south-east among the gorges; thence it turns southward into the plains, and enters the Amazon at a point about 60 miles west of the mouth of the Huallaga. So far as known, it is a stream of no value except for canoe navigation. Its rise and fall are rapid and uncertain, and it is shallow and full of sandbanks and snags. Immediately west, and parallel to the Pastaza, flows the Morona, the last stream of any importance before reaching the Pongo de Manseriche. It is formed from a multitude of watercourses which drain the slopes of the Ecuadorian Andes south of Sangai; but it soon reaches the plains, which commence where it receives its Cusulima branch. It is navigable for small craft for about 300 miles above its mouth, but it is extremely tortuous. Canoes may ascend many of its branches, especially the Cusulima and the Miazal, the latter almost to the base of the gigantic volcano of Sangai. The Morona has been the scene of many rough explorations, with the hope of finding it serviceable as a commercial route between the tableland of Ecuador and the Amazon river.

THE PAUTE AND ZAMORA.—A river called the Paute dashes through the eastern Andes from the valley of Cuenca, and a second, the Zamora, has broken through the same range from the basin of Loja. Swollen by many affluents, they reach the lowlands and unite their waters to form the *rio* Santiago, which flows into the Marañon at the head of the Pongo de Manseriche. There is but little known of a reliable character regarding this river, but Wolf says that it is probably navigable up to the junction of the Paute with the Zamora.

THE SOUTHERN DRAINAGE AREA OF THE AMAZON.—Before describing the southern affluents of the Amazon and the Tocantins, it is perhaps well to give a general outline of the region they drain. From the province of Pará one may follow the irregular *divortia aquarum* between the maritime section of Brazil and the Tocantins valley by a broad tableland range, scrub-covered and tufted with wiry grass, which extends south to the headwaters of this river, separating its valley *en route* from that of the Parnahyba and São Francisco, until it connects with the complex mountainous district to the west called the Serra dos Pyreneos, about lat. 15° 30′, and then continues south, and forms the divide between the valley of the São Francisco and that of the Parnahyba tributary of the great Paraná. Then, taking a tortuous course through the state of Minas Geraes, and rising into rolling hills, peaks, and table-topped summits, it merges into the irregular groups of

mountains which surround the headwaters of the São Francisco and Rio Grande branch of the Paraná. From its union with the Serra dos Pyreneos, it has a branch which trends south-west to the city of Goyaz, and thence, in a narrow range of highlands, under the names of Serra dos Divisões do rio Claro and Serra Cayapó, pushes southward to Paraguay, and forms a part of the eastern boundary of that country, under the name of the "Sierra de Amambay." Throughout its length, this extension is a part of the northern and western rim of the basin of the Paraná affluent of the Plata.

North-west of the Serras dos Divisões and Cayapó, which, with their many variously named dependencies, are locally known as the São Lourenço system, is an immense undulating plateau, about 1600 feet average height above the sea, although its northern margin rises at times to above 3000 feet. Between the rivers of the Amazon slope, it descends in vast rolling plains, through which the streams have cut their way down to the underlying rocks. The southern and western edge of the plateau, however, usually terminates in steep bluffs which overlook vast valleys and their ramifications, which the tributaries of the Paraguay river have eroded, frequently to a depth of a thousand feet below the general level of the tableland. The rivers so quickly reach the lower plains that rapids and cataracts are found only in their extreme upper courses.

From Cuyabá north-west to Villa Bella is a great region cut into intricate divisions by countless upper tributaries of the Tapajos, Guaporé, and Paraguay rivers. It is generally arid, with sandy, movable soil, pastureless and almost treeless.*

The Amazon and Paraguay river water-divide is very irregular, and is determined by the high northern margin of the plateau which, on the west, connects with the one lying north of Cuyabá, and then extends north-west into the Serra Parecys, which borders south-western Matto Grosso and overlooks the valley of the Guaporé affluent of the river Madeira for its entire length. It rises above the general level of the country from 1000 to 2300 feet, but gradually breaks down until its low, hilly spurs reach and abut upon the Madeira along its line of falls, where it disappears completely. To the north-east of this serra, between the Tapajos and Madeira rivers, lies an almost unknown area of the Brazilian plateau as large as France.

From the basin of the Tocantins, as far west as the river Madeira, are the remains of an undulating sandstone tableland cut into sections by many watercourses, its irregular elevations, hilly and at times mountainous ridges, mostly flat-topped, presenting bold escarpments overlooking the rivers which are constantly undermining them.

Little is known of the country west of the Madeira river boundary

* Da Fonseca, *op. cit.*

of Matto Grosso, and extending to the range of highlands which determines the course of the Ucayali river of Peru; but the whole region is so nearly level that the great rivers Purús, Juruá, Javary, and minor streams which find their way lazily across it, are among the most crooked in the world. In the rainy season, it is nothing but vast swamps and lakes, and is then uninhabitable.

THE TOCANTINS.—The Tocantins is the great central fluvial artery of Brazil, running from south to north about 1500 miles. It rises in the mountainous district known as the Pyreneos, whilst its more ambitious western affluent, the Araguay, has its extreme southern headwaters on the slopes of the Serra Cayapó, and flows a distance of 1080 miles before its junction with the parent stream, which it appears to equal in volume. Besides its main tributary, the *rio* das Mortes, which enters the Araguay from the west, it has twenty smaller but important branches offering many miles of canoe navigation. In finding its way to the lowlands, it breaks frequently into falls and rapids, or winds violently through rocky gorges until, at a point about 100 miles above its junction with the Tocantins, it cuts across a rocky dyke for 12 miles in roaring cataracts.

The tributaries of the Tocantins, called the Maranhão and Paranatinga, collect an immense volume of water from the highlands which surround them, especially on the south and south-east. Between the latter and the confluence with the Araguay, the Tocantins is occasionally obstructed by rocky barriers which cross it almost at a right angle. Through these the river carves its way, broken into cataracts and rapids, or *cachoeiras*, as they are called throughout Brazil. Its lowest one, the Itaboca cataract, is about 130 miles above the estuarine port of Cametá, for which distance the river is navigable; but above that it is useless as a commercial avenue, except for laborious and very costly transportation. The flat, broad valleys, composed of sand and clay, of both the Tocantins and Araguay, are overlooked by steep bluffs, those on the east of the Tocantins being especially abrupt. They are the margins of the great sandstone plateaux from 1000 to 2000 feet elevation, through which the rivers have eroded their deep beds. Occasionally, a great sandstone pedestal, much weather-worn, rises from the general level of the tableland, its talus representing the detritus of the slowly disintegrating mass. Around the estuary of the Tocantins, the great plateau has disappeared, to give place to a part of the forest-covered, half-submerged, alluvial plain which extends far to the north-east and west.

THE XINGÚ.—The next large river west of the Tocantins is a true tributary of the Amazon, the Tocantins being still in dispute as such. The Xingú was but little known until it was explored, in 1884–87, by von den Steinen from Cuyabá. Travelling 240 miles east, he found the river Tamitatoaba, 180 feet wide, flowing from a lake 25 miles in

diameter. He descended this torrential stream to the river Romero, 1300 feet wide, entering from the west, and which receives the river Colisú. These three streams form the Xingú, or Paraná-Xingú, which, from 73 miles lower down, bounds along a succession of rapids for 400 miles. It is navigable, for large vessels, for 105 miles above its junction with the Amazon, and at the head of navigation is 6500 feet wide. A little higher up, the river makes an immense bend to the east, to find its way across a rocky barrier. Here is the great cataract of Itamaracá, where the water rushes down an inclined plain for 3 miles, and then gives a final leap, called the fall of Itamaracá.* Near its mouth, the Xingú expands into an immense lake, and its waters then mingle with those of the Amazon through a labyrinth of *caños* winding in countless directions through a wooded archipelago. The country inland from the river on either side is almost unknown.

THE TAPAJOS.—The Tapajos, running through a humid, hot, and unhealthy valley, enters the Amazon 500 miles above Pará, and is about 1200 miles long. It rises on the lofty plateau near Diamantino, in lat. 14° 25′.† This town is seated on the *divide*, its southern slope draining to the Paraguay. Large boats are occasionally dragged across the watershed, a distance of about 20 miles. Castelnau says that 200 metres east of the Fazenda do Estivado the waters of the Arinos flow to the Tapajos, and 84 metres west of the same house is the Trombador tributary of the Cuyabá branch of the Paraguay. The Tapajos is the most western river of Brazil that scores its channel across the vast central plateau lying between the maritime belt and the Madeira.

Near Diamantino, a number of streams unite to form the river Arinos, which, at lat. 10° 25′, joins the Juruena to form the Alto Tapajos, so called as low down as the *rio* Manoel, entering from the east.‡ Thence to Santarem, the stream is known as the Tapajos. The lower Arinos, the Alto Tapajos, and the Tapajos to the last rapid, the Maranhão Grande, is a continuous series of formidable cataracts and rapids. An unobstructed reach of 15 to 20 miles is considered "very long" by Chandless. From the Maranhão Grande to its mouth, a distance of about 188 miles, the river can be navigated by large vessels. At Santarem, where the Amazon makes an unsuccessful attempt to choke it with sediment, it is less than three-quarters of a mile wide and 130 feet deep, and its black waters have almost no current.§ Below the last rapid, it gradually broadens out until its last 100 miles is from 4 to 9 miles wide, and much of it very deep. In the dry season the

* Prince Adalbert, of Prussia, entered the Amazon in 1842, fitted out a canoe expedition, and, overcoming many of the cataracts and rapids of the Xingú, reached a point about 400 miles above its mouth.

† Chandless, *Journal Royal Geographical Society*, vol. 32.

‡ Coudreau, 'Voyage au Tapajos.'

§ R. H. Smith, 'Brazil, the Amazon and the Coast.'

ocean tides are felt as high up as the head of navigation, but the slope of the river may be gauged by the elevation of the Salto Agusto, which, at lat. 8° 53′, is 1476 feet according to Coudreau.

The valley of the Tapajos is bordered on both sides by bluffs, which are the margins of the great tableland. They are from 300 to 400 feet high along the lower river, but, a few miles above Santarem, they retire from the eastern side, and only approach the Amazon flood-plain some miles below Santarem.

THE MADEIRA AND ITS AFFLUENTS.—The river Madeira has its junction with the Amazon 870 miles above Pará, and almost rivals it in the volume of its waters. It rises over 50 feet during the rainy season, and the largest ocean steamers may ascend it to the fall of San Antonio, 663 miles above its mouth; but in the dry months, from June to November, it is only navigable for the same distance for craft drawing from 5 to 6 feet of water. San Antonio is, according to the survey of Captain Selfridge, U.S. Navy, 1533 statute miles above Pará by river route.* Lieut. Perkins, U.S.S. *Enterprise*, determined its longitude west of Greenwich at 63° 55′ 14″ and lat. 8° 48′ 14½″, after numerous observations. In 1877, I sent an ocean steamer drawing 18 feet of water from Philadelphia to San Antonio.

The Madeira river commences at the confluence of the river Guaporé with the Mamoré.† Both of these streams have their headwaters almost in contact with those of the river Paraguay. Many writers have pointed out the ease and importance of cutting "a short canal" to give continuous inland navigation between the Amazon and Plata basins. Such an idea is based on ignorance of local conditions; hundreds of miles of rivers would have to be freed from obstructions and deepened before a route could be opened to serve for craft of even twenty tons burden.

San Antonio is the first of the formidable series of cataracts and rapids, nineteen in number, which, for a river distance of 263 miles, obstruct the upper course of the Madeira, until the last rapid, called Guajará Merim (or "small pebble"), is reached, a little below the union of the Guaporé with the Mamoré. The junction of the great river Beni with the Madeira is at the "Madeira" fall, a vast and grand display of reefs, whirlpools, and boiling torrents, among which I was wrecked in 1872. Between Guajará Merim and this fall, inclusive, the Madeira

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* In 1877 I went to Washington especially to explain to President Grant the great need of a survey of the lower Amazon and Madeira rivers. He recognized it at once, and almost immediately despatched the U.S.S. *Enterprise* to map these rivers as far as San Antonio.

† The Guaporé, although 1900 feet wide at its mouth, is, owing to less depth, inferior in volume to the Mamoré, although this is but 1300 feet wide at the junction. The Beni and Madeira at their confluence have, during the whole year, almost exactly the same cubic volume and discharge according to Keller's measurements.

receives the drainage of the north-eastern slopes of the Andes from Santa Cruz de la Sierra to Cuzco, the whole of the south-western slope of Brazilian Matto Grosso, and the northern one of the Chiquitos sierras —an area about equal to that of France and Spain.* The waters find their way to the falls of the Madeira by many great rivers, the principal of which, enumerating them from east to north-west, are the Guaporé or Itenez, the Baures or Blanco, the Itonama or San Miguel, the Mamoré, Beni, and Amarú-mayú or Madre de Dios, all of which are reinforced by numerous secondary but powerful affluents. The Guaporé presents many difficulties to continuous navigation; the Baures and Itonama offer hundreds of miles of navigable waters through beautiful plains; the Mamoré I have personally sounded, in the driest month of the year, for a distance of 500 miles above Guajará Merim, and found never less than from 10 to 30 feet of water, with a current from 1 to 3 miles an hour. I had its *rio* Grande branch explored, and it was reported navigable, for craft drawing 3 feet, to within 30 miles of Santa Cruz de la Sierra—a level, sandy plain intervening. The *rio* Grande is a river of enormous length, rising in a great valley of the *massif* of the Andes between Cochabamba and Sucre, and having its upper waters in close touch with those of the Pilcomayo branch of the great river Paraguay. It makes an enormous bend to the south-east, then runs north, and, curving to the north-west, joins the Mamoré at about lat. 15°. Its length is probably over 800 miles. Throughout its course it receives numerous torrential branches. The Chaparé, Securé, and Chimoré tributaries of the Mamoré are navigable for launches, up to the base of the mountains, within 130 miles of Cochabamba.†

The Beni has a fall, 18 miles above its mouth, called the Esperanza; beyond this, it is navigable for 217 miles to the port of Reyes, although, during the three dry months of the year, there are several shoals which can only be passed by craft drawing not more than 2½ feet of water. The extreme upper branch of the Beni is the river La Paz, which rises on the inter-Andean tableland near lake Titicaca. It runs in a deep cañon through the city of La Paz, winds around the south-western base of Illimani, saws through the inland range of the Andes in a deep gorge, and races down the mountain

* This drainage area gives the river Madeira a discharge among the falls of 305,616 cubic feet per second, according to the measurement of the engineer Keller. Its width along the falls varies from 1200 to 6600 feet, and its maximum depth 122 feet.

† The first steam craft to navigate the Madeira river and branches above the falls, was the *Explorador*, a little screw-steamer 40 feet long, built of Low-Moor iron, and not in sections. In 1871 I descended the falls with an expedition to meet her at San Antonio. The task of placing her upon the Mamoré, above the 263 miles of tremendous cataracts and rapids, I intrusted to Dr. Juan Francisco Velarde, a Bolivian of masterful energy and intelligence. He frequently had to haul her overland for miles through the tropical forests, and during the rainy season. He accomplished his task with superb courage, skill, and endurance.

slope to the Beni river. The La Paz and Beni as far down as Reyes are a torrent.

The principal branch of the Beni enters it 120 miles above its mouth, and is known as the Mayu-tata.* Its ramifications drain the north-eastern slopes of the Andes lying between 12° and 15° of latitude, and it greatly exceeds the Beni in volume. It was long thought to be a tributary of the Purús, until the brave but ill-fated Maldonado demonstrated that it belonged to the Madeira river system. It is navigable, in the wet season, to the base of the Andes, to within about 180 miles of Cuzco. Its upper waters are separated from those of the Ucayali † by only a short, transitable portage. When, however, the river is low, it is obstructed by several shoals and violent but surmountable currents, and its middle course has two rapids, each with the usual "head, body, and tail." It has sixty-three islands, great and small, from its mouth to its principal affluent, the Inambari (about 500 feet wide), which joins it from the south, flowing along the base of the Andes. General Pando, Colonel Juan Muñoz, and M. V. Ballivian, able and enthusiastic Bolivian explorers, the first now President of Bolivia, have given us interesting descriptions of the Mayu-tata and its navigability. Its bed is definitively formed, its banks solid, and the country it traverses is picturesque, and frequently of exceeding beauty.

All of the upper branches of the river Madeira cross the almost level Mojos and Beni plains, which rival, if they do not exceed, in fertility the Egyptian valley of the Nile, and are the most inviting and healthy agricultural and grazing region of the basin of the Amazon.

THE PURÚS.—This very sluggish river enters the Amazon west of the Madeira, which it parallels as far south as the falls of the Madeira. It runs through a continuous forest at the bottom of the great depression lying between the edge of the Brazilian sandstone plateau, skirted by the Madeira river, and the Ucayali, which hugs the base of the Andes. Chandless found its elevation to be only 107 feet above sea-level, 590 miles from its mouth. It is one of the most tortuous streams in the world, and its length in a straight line is less than half that by its curves. It is practically only a great drainage

* The numerous names given to this river by missionaries, historians, and explorers have greatly confused the geography of this part of South America. It has been called the Tono, Manú, Maynú, Manútata, Mayu-tata by the Tacana Indians who live along its banks, the Rio de Castella, Parabari, Manuariritya, and, by Padre Revello, the Madre de Dios. I prefer the Indian name, Mayu-tata.

† In 1894, a rubber-collector, Carlos Fermin Fiscarrald, having his establishment at the junction of the Tambo and Urubamba affluents of the Ucayale, ascended to the headwaters of this stream, and, "in 55 minutes," marched his party over the divide to the waters of the Mayu-tata. He hauled his small canoes across, built a large one, and descended this river to the settlements of the Bolivian rubber-collectors. *Vide* Official Report, Dr. Roman Paz.

ditch for the lake-flooded district it traverses. Its width is very uniform for 1000 miles up, and, for 800 miles, its depth is never less than 45 feet. It is navigable by steamers for 1648 miles, as far as the little stream, the Curumahá, but only by light-draught craft, which must be short to round the sharp bends of the river. Its branches add about 800 miles to its navigable waters. Chandless, that model explorer, ascended it, in 1864–5, for 1866 miles. At 1792 miles, it forks into two small streams. Occasionally a cliff touches the river, but, in general, the lands are subject to yearly inundations throughout its course, the river rising at times above 50 feet, the numerous lakes to the right and left serving as reservoirs. There are but seven islands in the whole river. Its main tributary, the Aquiry, or Acre, enters from the right, about 1104 miles above the Amazon, in lat. 8° 45′ and long. 67° 23′ W. from Greenwich. Its sources are in the high country lying north-west of those of the Mayu-tata; and, still further in the same direction, the Purús itself rises upon the slopes of the highlands which define the course of the upper Ucayali, which can be reached from the Purús by a portage of only a few miles, according to information obtained by Chandless from the Indians.

Many unsuccessful efforts have been made to find, what probably does not exist, a commercial route to the Beni districts by the rivers Purús and Aquiry, feasible during the entire year. The latter is navigable for a period of only about five months of the year, when the Purús valley below the Aquiry is inundated; and for the remaining seven months, only canoes can ascend it sufficiently high to communicate overland with the settlements in the valleys of the Mayu-tata and lower Beni; thus these regions are forced to seek communication with the Amazon river by the very dangerous, costly, and laborious route of the falls of the Madeira.

The Juruá.—West of the Purús, and having about two-thirds of its volume, is the Juruá river, also rising among the Ucayali highlands, and sharing with the Purús the bottom of the immense inland Amazon depression, and having all the characteristics of the latter river as regards curvature, sluggishness, and general features of the low, half-submerged forested country it traverses. Chandless found it navigable and unobstructed as far as he ascended, a distance of 1133 miles above its junction with the Amazon. At the highest point he reached, the river was still 30 feet deep.

The Javary.—The Javary, west of the Juruá, is the next important affluent of the Amazon from the south. It is the boundary-line between Brazil and Perú. It is supposed to be navigable by canoe for 900 miles above its mouth, to its sources among the Ucayali highlands, but only 260 miles have been found suitable for steam navigation. The Brazilian Boundary Commission ascended it in 1866 to the junction of the Shino with its Jaquirana branch. The country it traverses, in its extremely

crooked course, is very level, similar in character to that of the Juruá, and is a forested wilderness occupied by a few savage hordes.

The Ucayali, which rises only about 70 miles north of Lake Titicaca, is the most interesting affluent of the Amazon next to the Madeira. Perú has fitted out many costly and ably commanded expeditions to explore it. The first steamer ascended the Ucayali in 1866; the second expedition, of three small steamers, in 1867, claimed to have reached within 240 miles of Lima, and the smallest of them, the *Napo*, forced its way up the violent currents for 77 miles above the junction with the Pachitea river, as far as the mouth of the river Tambo, or Apurimac, 772 miles from the confluence of the Ucayali with the Amazon. The *Napo* then succeeded in ascending the Urubamba branch of the Ucayali 35 miles above its union with the Tambo, to a point 200 miles north of Cuzco. The remainder of the Urubamba, as shown by Bosquet in 1806, and Castelnau in 1846, is useless for commercial purposes; the latter describes it as constantly interrupted by cascades, reefs, and numberless other obstacles. The Tambo, or Apurimac, branch of the Ucayali, which rises in the Vilcanota knot of mountains south of Cuzco, is a torrential stream throughout its course, interrupted by reefs, cascades, and innumerable obstacles which render it unfit for navigation.

Admiral Tucker, who commanded the above-named expedition of 1867, found the mouth of the Tambo to be in lat. 10° 41′ and long. 73° 14′ W. from Greenwich, and 861 feet above sea-level. With a specially built steamboat, the *Tambo*, in 1870, he again reached the river Tambo; but 9 miles up this stream encountered a 7-mile current, which landed his vessel on a gravel bank and kept her there for a month, until January 3, 1871. Continuing up-stream, he found a 10-mile current, the incline of the river-bed being over 4 feet per mile. Two days after, and 45 miles up the Tambo, he reached the junction of the Ene and Perené, lat. 10° 58′ and long. 70° 26′ 30″, elevation 1000 feet. He then ascended the latter stream 15 to 20 miles, where he found very dangerous and insuperable rapids between enormous walls of rock, and, a mile further up, a cascade full of colossal rocks. He observed that the banks of the Ucayali for 500 miles up were generally very low. They are, in fact, overflowed in the wet season, and the neighbouring country extensively inundated.*

The Huallaga.—The Huallaga, which joins the Amazon to the west of the Ucayali, rises high among the mountains, in about 10° 30′ lat., on the slopes of the Cerro de Pasco. For nearly the whole of its length, it finds its way through a succession of gorges, an

* "The lower Ucayali, for 279 miles up, varies much in breadth, being in some places fully a mile and a half across, and in others not above half a mile. It runs from 3 to 4 miles an hour, and its average depth is 12 fathoms" (Smyth and Lowe, 'Narrative of a Journey from Lima to Pará').

impetuous torrent running seldom less than 6 miles an hour. Besides forty-two rapids, it has other formidable impediments to navigation, among which are many floating trees and snags. The last obstruction is the Pongo de Aguirre, so called from the traitor Aguirre, who passed there. The Huallaga can be ascended to this point by large river steamers, a distance of about 140 miles. Between the Huallaga and the Ucayali lies the celebrated "Pampa del Sacramento," a level region of stoneless, alluvial lands entirely covered with thick, dark forests, first penetrated by the missionaries in 1726. It is about 300 miles long from north to south, and varies in width from 40 to 100 miles. Many streams offering canoe navigation rise in the interior of this region. Some of them flow to the Ucayali, and others to the Huallaga. It is still occupied by savage tribes.

THE MARAÑON.—It is generally stated by geographers that this river rises in the little lake Lauricocha, in 10° 30′ S. lat., and 100 miles north-north-east of Lima. They appear to have followed the account originally given by Padre Fritz, which has since been found incorrect. According to Antonio Raimondi, the small stream issuing from the lake, and afterwards known as the Marañon, has a branch called the Nupe, of much longer course and greater volume than the outflow stream of the lake. The Nupe is, therefore, the extreme source of the Amazon river. The Marañon flows through a deeply eroded Andean valley, in a north-west direction, along the eastern base of the Cordillera of the Andes, as far as lat. 5° 36′; then it makes a great bend to the north-east, and, with irresistible power, cuts through the inland Andes, until, at the Pongo de Manseriche, it victoriously breaks away from the mountains to continue on through the plains under the name of the Amazon. Barred by reefs, and full of rapids and impetuous currents, it cannot become a commercial avenue. At the point where it makes its great bend, the river Chinchipe joins it from southern Ecuador, the mouth of this stream being in lat. 5° 28′ and long. 78° 33′ W. from Greenwich. Just below this, the mountains close in on either side of the Marañon, forming narrows or *pongos* for a length of 35 miles, where, besides numerous whirlpools, there are no less than thirty-five formidable rapids, the series concluding with three cataracts just before reaching the river Imasa, or Chunchunga, near the mouth of which La Condamine embarked in the last century to descend the Amazon. Here the general level of the country begins to decrease in elevation, with only a few mountain spurs, which from time to time push as far as the river and form *pongos* of minor importance and less dangerous to descend. Finally, after passing the narrows of Guaracayo the *cerros* gradually disappear, and, for a distance of about 20 miles, the river is full of islands, and there is nothing visible from its low banks but an immense plain covered with impenetrable forests. But the last barrier to navigation has yet to be passed—the Pongo de Manseriche, 3 miles

long, just below the mouth of the Rio Santiago, and between this and the old abandoned mission station of Borja, in lat. 4° 28′ 30″ and long. 77° 30′ 40″. According to Captain Carbajal, who descended it in the little Peruvian steamer *Napo* in 1868, it is a vast rent in the Andes about 2000 feet deep, narrowing in places to a width of only 100 feet, the precipices seeming to close in at the top. Through this dark cañon the Marañon leaps along, at times, at the rate of 12 miles an hour.*

The Amazon's Main River.—The Amazon river is navigable for ocean steamers as far as Iquitos, 2300 miles from the sea, and 486 miles higher up, for vessels drawing 14 feet of water, as far as Achual point. Beyond that, according to Tucker, confirmed by Wertheman, it is unsafe; but small steamers frequently ascend to the Pongo de Manseriche, just above Achual point. The average current is about 3 miles an hour; but, especially in flood, it dashes through some of its contracted channels at the rate of 5 miles. The U.S.S. *Wilmington* ascended it to Iquitos in 1899. Commander Todd reports that the average depth of the river, in the height of the rainy season, is 120 feet. During the period of its rise, it carries an immense quantity of drift-wood, and much of this, of great specific gravity, sinks to the bottom, as it becomes water-soaked. In the vicinity of Obidos, when the river is at its lowest level, at the beginning of November, a sudden rise is noticed; but it soon lowers again. It is the herald of winter. Some days later there is another rise, and on the second or third day the waters remain stationary and neither rise nor fall until this second impulse is at an end; then the river constantly increases in volume until June, when it reaches its maximum flood-level, and then falls until the end of October.† Wallace says that the waters begin to fall about June 21, seldom varying from that period. The rise of the Negro branch is not synchronous, for the steady rains do not commence in its valley until February or March. By June it is full, and then it begins to fall with the Amazon. According to Bates, the Madeira "rises and sinks" two months earlier than the Amazon.‡

The Amazon at times broadens to 4 and 6 miles. Occasionally, for long distances, it divides into two main streams, with inland lateral channels, all connected by a complicated system of natural canals

* Perhaps the most daring deed of exploration ever known in South America was done by the engineer A. Wertheman. He fitted out three rafts, in August, 1870, and descended this whole series of *pongos* from the *rio* Chinchipe to Borja. The thirty-five upper rapids and three cataracts he descended in six hours. At one point the river gradually narrowed, and was precipitated down an inclined plain between vertical walls not a hundred feet apart, until it reached the cataract of Mayasi, 15 feet high, over which his rafts were launched as if from a catapult.

† 'A região Occidental da Provincia do Pará.' D. S. H. Penna.

‡ From a river-level gauge which I had kept at São Antonio, on the Madeira (low-

cutting the low, flat *igapó* * lands into almost numberless islands. At the narrows of Obidos, 400 miles from the sea, it is compressed into a single bed a mile wide and over 200 feet deep, through which the water rushes at the rate of 4 to 5 miles an hour.

Travellers agree that the river may be ascended for hundreds of miles by side channels, winding through lakes and canals in the heart of virgin forests, without ever once entering the main stream. In the rainy season, it inundates the country throughout its course, to the extent of several hundred thousand square miles, covering the flood-plain, called *vargem*; and Wallace says that from the mouth of the Negro to that of the Içá, far in the interior, and even near the sources of the Negro, and on the upper waters of the Uaupés, are extensive tracts of land which are annually overflowed. Flood-levels above low river are in places from 40 to 50 feet high. Taking four about equidistant places, the rise at Iquitos is 20 feet; at Teffé, 45; near Obidos, 35; and at Pará, 12 feet.†

The first 200 miles of the northern margin of the Amazon are very low, and the great plains of Brazilian Guayana, which lie inland from the river, are at times almost entirely flooded.

The first high land met in ascending the river is on the north bank

water mark at the base of the fall being fixed at 150 feet), the following were the results obtained:—

	1872.	1873.	1874.	1878.
January	—	183·89	187·00	—
February	—	192·21	188·09	—
March	—	196·43	194·21	—
April	—	192·23	—	185·70
May	—	185·06	—	179·50
June	—	177·20	—	170·92
July	—	171·12	—	162·00
August	150·00	164·74	—	149·95
September	150·18	156·53	—	140·02
October	150·66	158·93	—	150·72
November	159·14	159·33	—	159·21
December	176·80	176·70	—	165·93

It will be seen that the rise in November and December corresponds to that of the Amazon near Obidos. It is evident, however, that both the rise and fall of the Madeira, and probably of the Amazon, fluctuates greatly according to the irregular annual rainfall of its basin, which at São Antonio, as shown by the rain-gauge, was, for 1873, 91·32 inches. May, June, July, and August were very dry, giving 9 inches of rain in 1873, and under 5 inches in 1878 during the whole four months. It would take the Madeira flood-wave about eight days to reach the Amazon from São Antonio.

* On the Amazon, the inhabitants distinguish the marginal lands as *igapó*, which is never more than 15 feet above low water; *vargem*, the land which by successive deposits has risen above the ordinary middle level of the river, and which is submerged at high water; and *terra-firma*, which the river never overflows, and which is the yellow-red clay, topped by thick forests, common to the entire river valley.

† See sketch-map of the Amazon near the mouth of the Tapajos, p. 383.

opposite the mouth of the Xingú, and extends for about 150 miles up as far as Monte Alegre. It is a series of steep, table-topped hills cut down to a kind of terrace which lies between them and the river. Monte Alegre reaches an altitude of several hundred feet. Inland and westward of it are the rugged hills of Ereré, 1000 feet high.

On the south side, above the Xingú, a line of low bluffs extends in a series of gentle curves with hardly any breaks nearly to Santarem, but a considerable distance inland, bordering the flood-plain, which is many miles wide. They then bend to the south-west, and, abutting upon the lower Tapajos, merge into the bluffs, which form the terrace margin of that river valley.

The next high land on the north side is Obidos, a bluff 56 feet above the river, backed by low hills. From Serpa, nearly opposite the mouth of the river Madeira, to near the mouth of the Negro, the banks are low, until approaching Manaos they are rolling hills; but from the Negro, for 600 miles, as far up as the village of Canaria, at the great bend of the Amazon, only very low land is found, resembling that at the mouth of the river. Vast areas of it are submerged at high water, above which only the upper part of the trees of the sombre forests appear. At Canaria, the high land commences and continues as far as Tabatinga, and thence up-stream. On the south side, from the Tapajos to the Madeira, the banks are usually low, although two or three hills break the general monotony. From the latter river, however, to the Ucayali, a distance of nearly 1500 miles, the forested banks are just out of water, and are inundated long before the river attains its maximum flood-line. Thence to the Huallaga, the elevation of the land is somewhat greater; but not until this river is passed, and the Pongo de Manseriche approached, does the swelling ground of the Andean foothills raise the country above flood-level.

Chandless, Keller, and Commander Todd appear to agree the best as regards the height of the Amazon above sea-level in the vicinity of the Purús, Madeira, and Negro.* Although their average would be only about 100 feet at about 1000 miles from Pará, my conviction is that it is far too high an estimate, and that the Amazon at the mouth of the river Javary, over 2000 miles from the sea, is not over 30 feet above the narrows at Obidos, and that whatever elevation there may be is due to the river having built up its own bed, and that the rise between sea-level and the narrows at Obidos, 523 miles above Pará by the river, is not over 6 feet. The tides, which at Pará are 12 feet, are

* There is so much divergence among explorers in the barometric measurements they have taken on the Amazon throughout its course, that we may suppose the atmospheric pressure in the interior is subject to changes not yet defined, and which defeat ordinary methods of observation. Wallace has observed that the variation of the barometer for three years at Pará was only three-tenths of an inch, and the mean height exactly 30 inches.

SKETCH MAP
OF THE
AMAZON
Near the mouth of the
TAPAJOS.
Scale of Miles
0 10 20 30
The dotted line indicates the
Edges of the Flood Plain
AMAZON
RIVER
TAPAJOS
R. CURUA
R. Curuay
MAECURÚ
RIVER
Hilly country
Stony Campo
or Plain of Erere
Sandy Campos
Campo Grande
(Stony Plain)
Lago
Grande
de Paracary
Sandy Campos
Numerous small
Lakes
Igarapé de Jacuruna
Igarapé Mahicé
Tapernum mirim
Tapernina
Bluffs 100 ft. High
Alter do Chão
Obidos
Curua
Troubotas
River
Lago de
Paricá
Furo de Sale
Pucas
Grande
Ilha
Grande
de
Arapixuna
Igarapé de Arapixuna
Igarapé de Curuá
Igarapé de Jacuruna
Igarapé de Mamiry
Igarapé de Jacuruna
Igarapé de Jacuruna
Igarapé de Jacuruna

felt up to this point, and would be felt higher but for the narrows. Bates measured their rise and fall, 3 inches, 530 miles from the sea, on a little tributary of the Tapajos.*

The Amazon is not a continuous incline, but probably consists of long level stretches connected by short inclined plains of extremely little fall, sufficient, however, owing to its great depth, to give the gigantic volume of water a continuous impulse towards the ocean.†

As to the lower Amazon, it presents every evidence of having once been an ocean bay, the upper waters of which washed the cliffs near Obidos.‡

Only about 10 per cent. of the water discharged by the Amazon enters it below Obidos, very little of which is from the northern slope of the valley. The drainage area of the Amazon basin above Obidos is about 1,945,000 square miles, and below Obidos only about 423,000, or say 20 per cent., exclusive of the 354,000 square miles of the Tocantins valley.

The width of the mouth of the Amazon is usually measured from Cabo do Norte to Punto Patijoca, a distance of 207 statute miles, but this includes the ocean outlet, 40 miles wide, of the Pará river, which should be deducted, as this stream is only the lower reach of the Tocantins. If any portion of the waters of the Amazon finds its way round the southern side of the large island of Marajo into the river Pará, it is only through tortuous *caños* and broad natural canals, which are in no sense outflow channels of the Amazon.

The tides here are very capricious, depending on numerous and ever-changing factors, seldom following the regular law. When beyond the reach of local influences, spring tides are 14 feet and neap 10 feet. In certain localities, flood tides run from 6 to 10 miles an hour.

Following the coast, a little to the north of Cabo do Norte, and for 100 miles along its Guayana margin up the Amazon, is a belt of half-submerged islands and shallow sandbanks. Here, the tidal phenomenon

* Observations have shown with certainty that there is a difference of level between the Amazon at its mouth and the sea. In the rainy season, when the stream should be strongest, the flood tide has the greatest velocity for a distance of 140 miles up the river. Therefore, it may be concluded that the waters of the sea are always higher than those of the river when the flood stream is stronger than that of the ebb, or from December to April inclusive, and that the waters of the sea are lower than those of the river, or at least have the same level, when the ebb-stream is stronger than the flood, which is the case from June to October (see 'South American Pilot,' Admiralty).

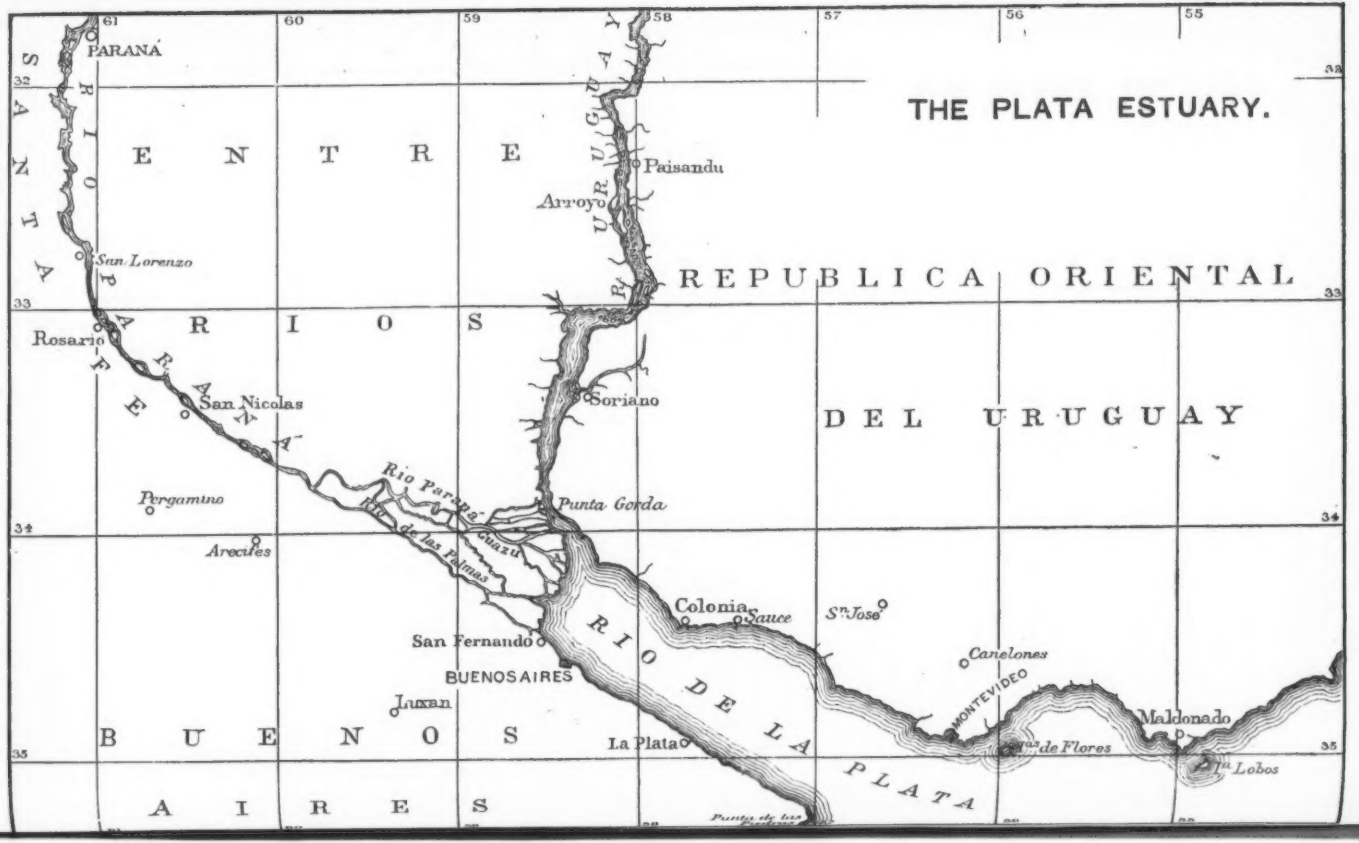
† It is the depth, not the slope of the bed, which principally governs the current of great rivers. The surface-current, as demonstrated by Révy, in his 'Hydraulics of Great Rivers,' is in proportion to the depth; that is, if it be 2 miles an hour where the water is 40 feet deep, it will be 4 miles where it is 80 feet deep, while the bottom current will increase in a greater ratio. Thus a very shallow river may require an incline of a foot to the mile to give it a flow of 3 or 4 miles an hour, while the Amazon, owing to its immense volume and great depth, may attain that velocity with a slope of less than a quarter of an inch per mile.

‡ See map of the Delta of the Amazon, p. 460.

called the bore, or *Pororoca*, occurs, where the soundings are not over 4 fathoms. It commences with a roar, constantly increasing, and advances at the rate of from 10 to 15 miles an hour, with a breaking wall of water from 5 to 12 feet high. Under such conditions of warfare between the ocean and the river it is not surprising that the former is rapidly eating away the coast, and that the vast volume of silt carried by the Amazon finds it impossible to build up a delta.

The Amazon is not so much a river as it is a gigantic, island-filled reservoir, extending from the sea to the base of the Andes; and, in the wet season, varying in width from 5 to 400 miles. Especial attention has been called to the fourteen main streams that discharge into it, but it receives a multitude of secondary rivers, which, in any other part of the world, would also be termed *great*.

Between eastern Brazil and the river Madeira, below its falls, the general slope of the country is inland, from east to west, and from British and Dutch Guayana to the Negro it is south-west. The lowering of Brazil in the direction indicated causes, in conjunction with the Andes, a depression in the heart of the continent, having an area of about 400,000 square miles. It is probably the bed of an ancient Amazonas lake, of such recent geologic age that for several months of the year a greater part of it is still under water. Roughly, its south-eastern boundary was the Madeira river, from the fall of Theotonio to the Amazon. Its north-eastern margin followed more or less the course of the Negro up to the mouth of the Uaupes. A line drawn thence to a point on the Ucayali, cut by lat. 7°, defines its north-western border. Its very irregular south-western shore extended in gulfs up the branches of the Purús and Juruá to the northern frontier of Bolivia. An arm of the lake, about 50 miles wide, pushed eastwards as far as Obidos, or perhaps further on to Santarem. This fresh-water *Amazonas sea* probably once received the outflow of the Mojos lake, which lay upon the level shelf of north-eastern Bolivia, at an elevation of 547 feet, across which several enormous rivers now find their way to the Madeira falls. They once flowed southward to the ancient Pampean sea, through the low gap which lies between the Andean *massif* and the Chiquitos sierras; but the rivers Grande and Parapiti, carrying huge volumes of alluvium from the Andes, threw a dam across this gap, and caused the formation of the Mojos lake, having an area of 115,000 square miles and a drainage basin of about 400,000. The Andes formed the western and south-western rim of the lake, and confined it, on the north, by low hills which they pushed down between the Purús and Mayutata rivers as far as the Madeira falls. The Matto Grosso highlands along the line of the Guaporé river were its eastern boundary, and the low Chiquitos sierras, overlooking the Gran Chaco, defined its south-eastern margin. When the Mojos lake reached the level of the lowest point of its northern barrier, the falls of the Madeira, it


THE PLATA ESTUARY.
PARANA
SANTA FE
RIO PARANA
ENTRE RIOS
BUENOS AIRES
REPUBLICA ORIENTAL DEL URUGUAY
RIO URUGUAY
Paisandu
Arroyo
San Lorenzo
Rosario
San Nicolas
Soriano
Pergamino
Rio Paraná
Punta Gorda
Arrecifes
Guazu
Rio de las Palmas
Colonia
Sauce
S.n Jose
San Fernando
BUENOSAIRES
Canelones
MONTEVIDEO
Maldonado
Luxan
La Plata
RIO DE LA PLATA
Punta de Flores
I.a Lobos
61
60
59
58
57
56
55
32
33
34
35

commenced to send its surplus waters to the north; and, when the falls were sufficiently eroded to nearly drain it, the present river-system of north-east Bolivia was formed. The ferruginous conglomerate reefs of the falls are not yet sufficiently worn down to keep the Mojos basin constantly drained, for the lake still has an area of 35,000 square miles during four months of the year.

The ancient Pampean sea * extended inland from the present Plata estuary to the base of the Chiquitos sierras at about lat. 19°, and occupied the area between the Andes and the high land which lies immediately east of the Paraguay and lower Paraná rivers.

The existence of the great Amazonas sea, Mojos lake, and Pampean sea at a remote epoch, especially when the Andes were at a much lower elevation than at present, must have greatly affected the climate of central and western South America, and, by taking them into consideration, many vexed and difficult ethnological and other problems relating to the continent may be found of easier solution.

Whether the Amazon once flowed west into the Amazonas lake, and gradually ate its way back until it broke out to the east near Obidos and drained the great lake, or whether this emptied into the Orinoco through the Casiquiare canal, or whether the barriers which held it on the east and north were sufficiently high to allow it to connect on the south with the ancient Mojos lake and Pampean sea, can only be determined by the collection of much more data than explorers have thus far given of this immensely interesting region.

The Rio de la Plata, so-called, is the next great doorway to the continental interior. The drainage area of the Plata basin is over two and a half times that of the entire Pacific slope of the Andes. The most fertile, healthiest, and best part of Brazil lies within it, including the states of San Paulo, Paraná, Santa Catharina, and the greater part of Rio Grande do Sul, which can only boast that the eastern slope of their sea-coast range of mountains drains directly into the Atlantic, while the southern parts of Minas Geraes, Goyaz, and Matto Grosso contribute vast areas to the great basin, which also embraces the whole of Paraguay and south-eastern Bolivia, and part of the Argentine Republic.

The Rio de la Plata is a funnel-shaped estuary extending west-north-west from the sea about 170 miles.† Its extreme breadth at its mouth, is 138 miles, narrowing quickly at Montevideo to 57, and at its head, where it receives the Paraná and Uruguay rivers, its width is about 25 miles. The northern, or Uruguayan shore, is somewhat elevated and rocky, while the southern, or Buenos Ayrean one, is very low, and

* For my detailed description of the Pampean sea and Mojos lake, see the *Geographical Journal*, October, 1898.

† See map of the Plata Estuary, p. 386.

much of it has a *tosca* cap which gently dips under the river-bed. The whole estuary is very shallow, and in no place above Montevideo exceeds 36 feet in depth at low river. Its bottom generally consists of enormous level banks of sand, covered with from 10 to 20 feet of water. It offers a continuous and intricate channel of only about 22 feet depth, at average low river, to within about 14 miles of Buenos Ayres. This remaining distance has a depth of, at most, 18 feet in the uncertain channel. At times, however, the river is so low that for three or four days together carts can drive out a distance of 3 miles or more from the shore.*

The water-divide between the headwaters of the Madeira branch of the Amazon and those of the Paraguay river is, at the most, 817 feet elevation, and a part of it is formed by the low range of Chiquitos sierras lying between the Andean *massif* and Brazil. From these sierras, the country slopes very gently southward as far as the Bermejo river; thence for about 250 miles to the *rio* Salado it is nearly level, being the undisturbed bottom of the ancient Pampean sea; and thence, after a light swelling up, the country gradually slopes off to the Atlantic ocean south of the Plata estuary.

The portion of this region from the Chiquitos sierras to the Salado, much of it forested with hard woods, is called the Chaco. It is dry, arid, and sandy, especially its northern part from the foothills of the Andes to the vicinity of the rivers Paraguay and Paraná; but going south of the Salado the lands improve in quality, and gradually the Pampean formation gets richer and richer, until, spreading over the immense province of Buenos Ayres, it presents a bed of earth of great thickness and of almost matchless fertility.

The country lying west of the Sierra de Cordoba and the province of Buenos Ayres, is arid, sandy, and poorly watered, and in its northern portion there are saline areas of immense extent.

Paraguay and Uruguay I have already outlined. "Between the rivers Paraná and Uruguay, lies the Argentine Mesopotamia, the provinces of Corrientes and Entre Rios, covered with modern alluvium. The former is gently undulating, and is half submerged by lagoons, the largest, lying in the north, being the famous Ybará. The south and south-western part of Entre Rios is composed extensively of argillaceous earth, and the whole province is traversed by ridges of low hills, running nearly north and south, the main ones never exceeding an altitude of 650 feet." †

THE URUGUAY RIVER has a length of about 1000 miles. Many small

* "In the year 1795, the waters fell so much in a calm day that for 3 leagues out the shore was exposed, remaining so a whole day" (Azara, 'Historia del Paraguay').

"A severe north-west storm in 1792 altered for three days the course of the waters of the Plata, and left dry almost the whole upper part of this great river" (Lobo y Rudavets, 'Manual de la Navegacion del Rio de la Plata').

† See 'Argentine Geography,' etc., *op. cit.*

streams from the western slope of the Serra do Mar unite in about lat. 27° 45′ to form the river Uruguay, which then, in imposing volume, flows west-north-west, forming the boundary-line between the Brazilian states of Santa Catharina and Rio Grande do Sul, as far as long. 52° W., near which it receives a considerable river from the north, called the Pepirí-guazú. Throughout this section it is enriched by many minor tributaries, mostly from the highlands which cross the state of Rio Grande do Sul. From the time it leaves the Atlantic coast range of Brazil, it runs for a long distance through a beautiful, open, hilly country until it enters thick forests which cover high hills.*

At the river Pepirí-guazú the Uruguay turns suddenly to the south-west, and continues this course to its junction with the Paraná. Near Fray Bentos, 61 miles before reaching the Plata, it flows into a great lake about 56 miles long and 4 to 6 wide, which is free from islands; but, above this lake, there are many large and small ones. At Punta Gorda, where the Uruguay debouches into the Plata, it is only 1 mile to 1½ miles wide, but 90 feet deep.

From the Pepirí junction, the banks of the Uruguay are high and forest-covered as far down as about lat. 27° 50′, where the river is 2300 feet wide, and from 10 to 40 feet deep. Thence its course is through a smooth and generally open, but occasionally broken country; but along the lower 100 miles of its eastern side there are picturesque hills from 100 to 500 feet high, divided by many rivulets which fertilize rich valleys beyond; but the Entre Rios margin is low, monotonous, and wooded. Between lat. 27° 58′ and 33° 24′ it receives, from the east, three important tributaries, the Ipui-guazú, the Ibicui, and the Negro, the latter being the principal. A few rivers of minor importance enter it from the Argentine provinces of Misiones, Corrientes, and Entre Rios, the Gualeguaychu being the largest.

The Pepirí-guazú was the limit between the possessions of Portugal and Spain. In its lower course it is about 250 feet wide, but it afterwards narrows to about 30 feet, and runs with great violence between high wooded banks. It is navigable by canoes for about 70 miles up from its mouth, as far as the Great Fall.

The Negro is the main tributary of the Uruguay, which it joins through a large delta of several islands. Its extreme headwaters are in the southern part of Rio Grande do Sul, but the main river belongs entirely to Uruguay, which it cuts midway from north-east to south-west. *En route* to the Uruguay river, it receives a number of copious affluents, and waters a most fertile and beautiful region. The lower reaches are navigable for craft of moderate draught.

The Uruguay is much obstructed by rocky barriers. Four miles below its confluence with the Pepirí-guazú it has a great cataract,

* Lobo y Rudavets, *op. cit.*

about 8 miles long, which rushes down a much-broken inclined plane with a total fall of 26 feet at low water. The river near the Pepirí-guazú is 1550 feet wide; but about 1½ mile before reaching the cataract its width is reduced to 600 feet. Along the cataract it is closed in between high precipitous walls of black rock, only 70 feet apart.

Above Punta Gorda, 212 miles, is the Salto Grande, with a length of 15 miles of rapids, the greatest single fall being 12 feet, and the difference of level for the entire length of the reefs 25 feet. The reefs cross the river diagonally, and during floods, all but a length of 1½ mile of them are submerged. Nine miles below the Salto Grande, is the Salto Chico, which bars navigation during six months of the year; but in flood-time it may be passed by craft drawing 5 feet of water.

The Uruguay can be navigated by vessels drawing 4½ feet of water, at all seasons, as high up as the *Salto Chico*, lat. 31° 21′, and with a draught of 14 feet, as far as Paysandú for a greater part of the year. Fray Bentos may be reached all the year by any vessel that can ascend the Paraná.

Above the navigable lower river, and between the rapids, which are met from time to time, there is launch and canoe navigation for many hundreds of miles upon the main artery and its branches.

The Uruguay has its annual floods due to the rains in its upper basin. They commence at the end of July, and continue to November, attaining their maximum during September and October. At the narrow places it rises as high as 30 feet, but its average rise is 16 feet. It flows, almost throughout its course, over a rocky bed, mostly composed of red sandstone, which is at times very coarse, and then again of extremely fine composition. Except in floods, it is a clear-water stream, and, even at its highest level, carries but comparatively little silt.

The Paraná.—The Rio Grande and Paranahyba unite to form the Paraná, the "Mother of the Sea" in Guarani. It drains a vast area of southern Brazil, and is about 1600 miles long from its extreme source in Goyaz to its junction with the Paraguay, and thence 600 more to the Plata estuary, its average width, for the latter length, being from one to three miles. The Grande is about 680 miles long, but it is only navigable in the stretches between the many reefs, falls, and rapids which interrupt its regular flow. It is formed from the union of many streams which descend from the slope of the Serra da Mantiqueira, in the region where the orographic system of Brazil culminates near the peak of Itatiaia-assu, almost in sight of Rio de Janeiro.

The main branch of the Paranahyba rises in about lat. 15° 30′ on the southern slopes of the Pyreneos mountains, and receives numerous tributaries before its confluence with the Grande, near which it is barred by two cataracts. It drains a little-known region of southern Goyaz and western Minas Geraes lying upon the southern watershed of Brazil.

Besides these rivers, the Paraná has many long and powerful affluents which enter it from the states of São Paulo and Paraná; but its western ones, limited in length by the Serra Cayapó and the highlands which border north-eastern Paraguay, are not of equal importance. Most of them, although obstructed by rapids, are navigable by launches and canoes. Among the eastern ones are the Tieté, the Paranapanema, formerly known as the Anemby, and the Iguazú. The first, over 700 miles long, rises in the Serra Paranapiacaba, and flows in a north-west direction. With the *rio* Pardo, it was the favourite route of the *Sertanistas*, explorers and raiders of Matto Grosso, although its course is broken by fifty-four rapids, and the lower river by two great falls, the Avanhandava, of 44 feet, and the Itapura, of 65 feet.

The Paranapanema is above 600 miles in length, and rises in a ramification of the Serra Paranapiacaba, which overlooks the Atlantic ocean. Its general course is north-west. From the south, it receives many important tributaries, but, from the north, its score of affluents have but little volume. It is navigable for a distance of about 30 miles above its mouth, and, throughout its course, it has many obstructions, which destroy its utility for commercial purposes.

The Iguazú, also called the *rio* Grande de Curutiba, has its head-waters on the slopes of the Serra do Mar, and flows nearly west through thick forests along the line of the 26th parallel of latitude. Its navigation is difficult even for small craft, as it is full of reefs, rapids, and falls. Its mouth is about 800 feet wide, and its middle depth about 40 feet. Sixteen miles above its mouth is the magnificent Salto de Iguazú, sometimes called the Victoria fall, round which canoes have to be transported 37 miles before quiet water is reached again. The volume of water which the Iguazú receives from its four principal affluents and a multitude of small streams is large, and as its combined flood tumbles 140 feet over the falls, into a wild gorge, the scene is of imposing grandeur.

The Paraná, at a point 28 miles above the mouth of the river Tieté, is interrupted by the falls of Urubuponga, but below these has unobstructed navigation for about 400 miles, as far down as the falls of Guaira (or Sete Quedas), about lat. 24° 3′, where the river gathers its waters into a great lake 4½ miles long and 2½ miles wide, preparatory to breaching the Sierra de Mbaracayú, which there disputes its right of way. With irresistible force, it has cut a deep gorge through the mountains for a length of about 2 miles, where, separated into several channels, it leaps along rapids and over cataracts, until it finally gathers its waters into a single volume, to plunge with frightful velocity through a long cañon only about 200 feet wide.

From the falls of Guaira, the Paraná, as far as its confluence with the Paraguay river, has carved its narrow bed through a red sandstone formation, along which it sometimes flows with much violence,

occasionally being interrupted by dangerous narrows and rapids, where the river-banks at times close in to a width of 450 to 600 feet, although its average is about 1200 to 1600 feet. At the south-east angle of the state of Paraguay, it is prevented from continuing its southern course to the river Uruguay by the highlands which cross the Argentine province of Misiones, and connect those of Rio Grande do Sul with the Caa-guazú range of Paraguay. Here, therefore, it is turned westward; but, before escaping from its great sandstone bed, it is obstructed by several reefs, notably at the rapids of Apipé, which are the last before it joins the placid Paraguay, 130 miles further on, to thenceforth flow without interruption to the sea. From the Apipé rapids, there is a great triangular space at the south-west corner of the state of Paraguay, but little above sea-level, consisting of low, sandy ground and morasses, at times flooded by the Paraguay river. This district, united to the equally enormous one occupied by the Yberá lagoon and its vast surrounding morasses, in the northern part of the Argentine province of Corrientes, was probably the delta of the Paraná river when it emptied into the ancient Pampean sea. The Paraná is charged with but little silt in comparison to its much smaller affluent, the Paraguay; but in flood it carries a volume of water estimated to be ten times that of the latter stream, and its width along the northern sandstone border of the province of Corrientes is from 3 to 9 miles.

The river Paraguay, the main affluent of the Paraná, rises in Matto Grosso, in the vicinity of the town of Diamantino, about lat. 14° 24′. It flows south-west, as far as Villa Maria, along the foot of the high plateau which divides it from the Cuyabá river to the east; and then, turning southward, soon reaches the morass-lake of Xarayes, which it traverses for about 100 miles until its junction with the *rio* São Lourenço. A few miles below Villa Maria, it has an affluent from the north-west, the Jaurú, which has its source nearly in contact with the headwaters of the Guaporé branch of the river Madeira. The Cuyabá river, which is called the São Lourenço for 90 miles above its junction with the Paraguay, has its sources in lat. 13° 45′, almost in touch with those of the Tapajos. The Cuyabá crosses near them from north-east to south-west for a distance of 150 miles, and is only separated from them by the narrow plateau-ridge of Trombador, which, at places, is not 3 miles wide. As the Cuyabá flows onward, it is enlarged by a number of minor streams, especially from the north-west, until it reaches the spur of the great sandstone plateau, at the south-eastern point of which the town of Cuyabá is situated; thence it enters the upper margin of the vast, swampy and inundated region between the Paraguay and São Lourenço. Just below the point where it takes this latter name, it is 700 feet wide. Above the town of Cuyabá, the river is from 150 to 400 feet wide, and may be navigated up stream for 150 miles by canoes, but there are many rapids. The town may be reached from the Paraguay at low

water, by craft drawing 18 inches. According to the numerous observations of Clauss, Cuyabá is only 660 feet above the sea. Thus, again, we see how slight is the elevation of the interior of South America.

From the junction of the São Lourençó (or Cuyabá) with the Paraguay, the latter, now a great river, moves sluggishly southward, spreading its waters in the rainy season for hundreds of miles to the right and left, as far south as lat. 20°, and turning vast swamps into great lakes, like that of Mandiore on the Bolivian side; in fact, temporarily restoring the region for thousands of square miles to its former lacustrine condition.

The first river of importance entering the Paraguay from the east (about lat. 19°) below the Cuyabá is the Taquary, which rises in the Serra Cayapó on the southern extension of the Matto Grosso table-land. It is a river famous in the history of the slave-raiders from São Paulo in the sixteenth century. I shall have occasion to describe the route they followed when I treat of the commerce of the country. South of this stream about 50 miles, a considerable river, the Mondego, with many branches, draining a great area of extreme southern Matto Grosso, also flows into the Paraguay; and still further south, near lat. 21°, is its very straight tributary, the Apa, which is the boundary-line between Paraguay and Matto Grosso. From northern to southern Paraguay, the western drainage slope of the country has numerous short streams which swell the parent river.

The Pilcomayo.—From the west, the Paraguay has but few and very short tributaries until it receives the Pilcomayo, the country being too flat and the soil too sandy and thirsty to allow any large amount of water to reach the great river. The Pilcomayo is of more importance as regards its length than its volume. It rises in the Andean *massif* north of Mount Potosi. It races down the mountains to their base, and then crosses the Chaco plains to join the Paraguay nearly in front of the city of Asuncion. It receives no branch of importance until it reaches about lat. 21°, where it is joined, from the south-west, by the river Pelaya, upon which Tupiza, the most southern city of Bolivia, is situated. The Pelaya rises upon the lofty inter-Andean plateau, and, taking an eastern course, saws its way across the inland Andean range, turns north and then east to unite with the Pilcomayo, which it is said to, at least, equal in volume. Just below the junction is the fall of Guarapetendi, 23 feet high. From this point to the mouth of the Pilcomayo the distance in a straight line is 480 miles, although by the curves of the river, which is extremely tortuous, it is about double that distance. According to Storm, who quotes Captain Baldrich, the river bifurcates, at lat. 21° 51′, to again become a single stream at lat. 23° 43′, the right channel being the greatest in volume. It is probable that, between 23° and 24° south, it throws east-south-east three great arms to the river Paraguay, the upper portions of which have yet to be explored, but the

lower parts have been examined, for 100 to 200 miles, up from the Paraguay. Enumerating from north to south, they are called the Esperanza, the Montelindo, and the Macá. From 180 to 200 miles above its mouth, the Pilcomayo filters through a vast swamp about 100 miles in diameter, through which there is no principal channel. This swamp, or perhaps shallow lagoon, is probably partly drained by the river Confuso, which reaches the Paraguay between the Pilcomayo and Masá. A northern branch of the Pilcomayo, the Fontana, the junction being at 24° 56′ lat., is probably also a drainage outlet of the same great swamp. For the first 100 miles below the fall of Guarapetendi, the Pilcomayo is from 600 to 1000 feet wide, but it so distributes its waters throughout its many bifurcations, and loses so much from infiltration and in swamps, and by evaporation from the numerous lagoons it forms on either side of its course, that its channel is greatly contracted before it reaches the Paraguay. It is possible that its Montelindo outlet may be the main river. From Sucre to the Andean margin of the Chaco, a distance of about 350 miles by the river, the fall is, at least, 8000 feet; a sufficient indication that any navigable parts of the stream must frequently give place to torrents and rapids, making its upper course useless for purposes of navigation. The statements made by explorers regarding the Pilcomayo are very confused. This is probably due to the wandering propensities of the river, and the immense areas of country it overflows in flood time. The missionaries, in 1556, first reported the existence of the Pilcomayo, which, for a long period of time, was known as the Araguay. The first definite information regarding its course was given by the expedition of Armenta y Zarate, which descended its valley, by land, for a considerable distance in 1672. In 1721, Patiño and Rodriguez partially explored it, and, since then, numerous attempts have been made, by various explorers, to test its navigability, all of which have been failures; and several of them have ended in disaster and loss of life, so that the Pilcomayo now has a sinister reputation.

The Bermejo river parallels the Pilcomayo, and enters the Paraguay a few miles above the junction of this with the Paraná. Its numerous sources are on the eastern frontage of the inland Andes, between the Bolivian town of Tarija and the Argentine city of Jujuy. Its most northern tributary is the San Lorenzo, which, after being augmented by several small streams, takes the name of Rio de Tarija. This, running east, is, in turn, swollen by several affluents, and then, taking a general south-east course, joins the Bermejo, in lat. 22° 50′, at a point called the Juntas de San Antonio. Thence, flowing southward, the Bermejo is enriched by many tributaries from the Andean gorges, and, finally, at lat. 23° 50′, receives its main affluent, the San Francisco, from the south-west. The latter has its source in about 22° 30′ lat., and, under the name of *rio* Grande, runs directly south,

in a deep mountain valley, as far as Jujuy. It then turns east for 50 miles, where it is joined by the Lavayen, from the south-west. These two streams form the San Francisco, which from their junction, runs north-east to the Bermejo. The average width of the San Francisco is about 400 feet. It is seldom over two feet deep, and has many shoals and sandbanks. From its junction with the latter stream, the Bermejo flows south-east to the Paraguay, with an average width, in its main channel, of about 650 feet, although narrowing at times to 160 and even 100. In its course, however, it bifurcates and ramifies into many channels, forming enormous islands, and frequently leaves old beds for new ones. During floods, it inundates immense areas of the flat Chaco country, filling vast lagoons and swamps on both sides of the river, which, at such times, becomes of indefinite width. Since the exploration of it by Patiño, in 1721, it has often been examined from its sources to its mouth, with a view to ascertain its value for commercial purposes. Captain Page, in 1854 and 1859, found it impracticable to ascend it over 135 miles in the dry season, with a little steam-craft drawing but 23 inches of water; but, in 1871, when the floods commenced in December, he succeeded, in 60 days, in reaching a point 720 miles from its mouth in the steamer *Alpha*, 53 feet long and drawing 30 inches of water. He afterwards penetrated another 100 miles up-stream. The round voyage took a year, the progress made being very slow, owing to the swift currents, shoals, quicksands, fallen trees, and snags.

The Salado, about 250 miles south-west of, and approximately parallel to, the Bermejo, is the first great tributary which the Paraná receives from the west below its junction with the Paraguay. Its extreme headwaters are in the Argentine province of Salta, and they drain a much-broken Andean region lying between 24° and 26° 30′ lat. The most western sources are the rivers Santa Maria and Calchaqui, which unite near the town of San Carlos and form the river Guáchipas, which flows north-east until it meets the Arias, which has collected in a single channel various small affluents from the north and west. Having received the Arias, the Guáchipas runs north-east about 50 miles, where it changes its name to the Juramento, which is retained until the river reaches the Chaco plains, at the base of the foothills of the Andes. Here it becomes the Salado, a name it preserves for the remainder of its course. It joins the Paraná near Santa Fé, lat. 31° 39′, and long. 60° 40′ W. From the time the Salado leaves the foothills, it lazily rambles across the plains, in a south-east course, now in a single channel, then bifurcating into several branches and forming long islands, and again flooding to the right and left into great lagoons and swamps, sometimes to a width of 60 miles. In the dry season, it is a narrow, crooked stream, full of shoals and snags. At all times it carries an immense quantity of floating vegetation and trunks of trees, which constantly fall from its crumbling banks. Explorers of the

river, inclusive of Captain Page, in 1855, claim that its lower half is navigable. This may be true, but the many efforts which have been made to utilize it for commerce have been failures. The Salado occupies the south-west side of a very level depression 250 miles across from south-west to north-east, and only 240 feet above the sea. Along the north-east side of this depression runs the Bermejo.

As the Pilcomayo, Bermejo, and Salado wander about the country, ever in search of new channels, they constantly erode and tear away great quantities of the Pampean material, dissolve it into silt, and pour it into the Paraguay and Paraná. Pelleschi estimates that "the soil annually subtracted from the territory of the Chaco, by the Bermejo alone, equals 6,400,000 cubic yards."

South of the Salado, the rivers Saladillo, Primero, and Segundo provide the water for the evaporation from the great inland lake of Porongos. The Tercero and Quarto streams unite and empty into the Paraná near Rosario with a considerable volume of water. The Quinto, with other small rivers, draining the southern spurs of the Cordova range, are absorbed by the thirsty Pampean swamp, La Amarga.

From Paraguay south, the eastern side of the Paraná shows a series of sandstone bluffs for 30 miles, and thence, for 240 miles, the inland borders sometimes rise to a height of 80 feet, and then, at Goya, descend almost to the river-level. Near the boundary-line between Corrientes and Entre Rios, the banks are very low on both sides of the river, and continue so for nearly 100 miles; but onward for 150 miles, the left bank is margined as far as Diamante by a range of hills from 125 to 160 feet high, at times boldly escarped. At Diamante, the hills trend inland south-east for about 50 miles. They probably once formed the border of an ancient channel of the river. From lat. 31° 30′ to the head of the Plata estuary, the western bank of the Paraná is a precipitous bluff of reddish clay, varying from 25 to 75 feet above mean river-level. It is being gradually undermined, and tumbles into the water in great blocks, to add to the immense volume of silt which the river carries. "The lowest level of the Paraná is in October and November, and, save an occasional freshet, it remains stationary until the beginning of summer, when its waters begin to rise, reaching their maximum about the middle of February in the lower part of their course." *

The difference between low and high river is generally about 12 feet, depending upon the varying quantity of rains in Brazil and the melting of the Andean snows. The current of the Paraná averages, from its junction with the Paraguay, about 2½ miles per hour, and the river varies at low water from 1 to 3 miles in width; but, in floods, it seems almost a continuous lake, broadening from 10 to 30 miles, and burying

* 'El Territorio de las Misiones,' por Ramon Lista.

many of its numerous islands and marginal swamps in a vast sheet of water, obliterating its many parallel lateral channels and intricate systems of connecting canals. In the middle Paraná, from the mouth of the Iguazú to the mouth of the Paraguay river, there are many islands, some of them large, rocky, and high above the river. Islands are numerous from the mouth of the Paraguay to the city of Rosario, some of them of great area, and, again, below this point, they soon increase in number and size until the Plata river is reached. They are mostly covered with dense and beautiful vegetation, which, in the lower river, is dark green mingled with bright crimson foliage of the seibo tree. The upper portions of the trees, being out of water in flood times, appear like floating forests. Then the river often makes wild work with its banks, and builds up or sweeps away entire islands, leaving deep channels in place of the latter. Mouchez, in 1857, searching for two islands, the position of which he had fixed the previous year, found, in the place they had occupied, a depth of 25 and 32 feet of water.* The estuary of the Plata must have extended, in a very recent geological period, inland from its present head to at least lat. 32°; but the enormous amount of silt which the Paraná receives from its Paraguay affluent and from the tributaries which reach it from the Andes, has filled the lower length of about 220 miles with these muddy islands resting on a sandy bed of great depth. The frontage of the Paraná delta is 40 miles across, almost in a straight line from north to south. Through this, the river finds its way to the Plata by eleven outlets, large and small. The marked regularity of the frontage is due to the current of the Uruguay river cutting across its face and carrying the silt to the south-west, until it meets the outflow of the Paraná de las Palmas, which sweeps it south-east along the Buenos Ayrean shore.

The Paraná has been struggling, probably for many centuries, to extend its delta further into the Plata estuary, but has been defeated by the river Uruguay. The contour lines of the bottom, at the head of the estuary, show, however, that the Paraná has been gaining ground, and has outlined the base of a great island, which it is gradually building up, and which must ultimately emerge from the water, leaving the Paraná Guazú between it and the Uruguay shore. When this has been effected, the lower Uruguay will be turned to the south-east, and no longer impede the rapid extension of the Paraná delta over the vast, flat area of the Rio de la Plata.†

The mean flow of the Mississippi river at New Orleans is 675,000 cubic feet per second, and its flood maximum about 1,000,000. The

* The lower delta of the Paraná does not share in these phenomena; its islands and main channels appear more fixed. This probably is due to the less elevation attained by the waters, and the numerous branches which distribute them into the Plata estuary.

† See map of the Delta of the Rio Paraná, p. 460.

minimum of the Plata, past Buenos Ayres, is 534,000 cubic feet per second, the maximum 2,145,000. It may therefore be fairly assumed that the yearly discharge of the great North American river is not superior, and may be inferior, to that of the Plata.

The Paraná is navigable at all times as far up as the São Lourenço river by craft drawing 3 feet of water, and to within a few miles of Asuncion, the capital of Paraguay, by vessels drawing 9 feet. The city of Paraná may be reached with a draft of 12 feet, and Rosario with 15 feet of water.

Communication by land between southern Matto Grosso, northern Paraguay, and the eastern Andean slopes of Bolivia is extremely difficult. The distance over a level road from Curumbá (lat. 19°, long. 57° 45′ W.), on the Paraguay river, to Santa Cruz de la Sierra is 570 miles. In the dry season the country is as wanting in water as it is overflowing in the wet months, and beasts of burden frequently die of thirst, or are drowned in the effort to cross it.

Under Spanish rule, the Government of Paraguay, at an early date, was especially charged to open a route to Perú across the Chaco. Flores, one of the commissioners, in 1756, complained to the Marques de Valdeliros that the archives of Asuncion contained nothing upon the subject, nor even the memory of the road which, in previous times, was used by the inhabitants of Perú and Paraguay. He characterized the western bank of the river Paraguay as "an interminable gulf of land." We shall hereafter find that the difficulty of transit of this Chaco area had a salient influence upon the commercial development of colonial South America.

To the west, the Plata basin is walled in from the Pacific ocean by the Cordillera of the Andes; to the east, are the mountains of Brazil, and a gigantic river system too formidable to bridge with profit; to the north lies the heart of the continent and the vast counterforts of the inland Andes; to the south is a facile exit to the Atlantic, through the Rio de la Plata. At the head of this estuary, the principal terrestrial as well as all of the fluvial trade routes concentrate. They traverse a land teeming with resources, and give life, vigour, and prosperity to an emporium which is rapidly becoming one of the greatest in the world.

Bahia Blanca * is the *fourth doorway*, and the natural commercial outlet of an area of country greater than the valley of the Orinoco.

As lat. 30° is passed, going southward, the eastern slope of the Cordillera of the Andes begins to receive a sufficiently increased rainfall to supply the waters for the western system of Argentine rivers which try to find their way to the river Colorado, but which they only reach at rare intervals when some exceptionally heavy storm aids their effort to satiate the sandy desert which they traverse. One of these streams,

* See map of the Estuary and Port of Bahia Blanca, p. 399.

THE ESTUARY AND PORT
OF
BAHIA BLANCA
Depths in Fathoms
Zuraita
Island
Great North
Bank
Upper Toro Bank
Punta Alta
Punta Pipa
Three Fathom C.
Arroyo de Pe Alta
Inner Harbour
Bahia Blanca
Mt. Observation
Sharp Hill
Mt. Divisadero
Tecada Pt.
Nameless Pt.
Cabeza Cuperea
Punta Cuperea
Porage Cr.
Dentata Hill
Fort Belgrano
River
Creek
Lagoon
Harbour
Bay
Cr.
Pt.
Hill
Mt.
62°
55'
50'
45'
40'
30'
39°
58'
60'

the Vinchina, rises as far north as lat. 27° 30′ in the Argentine province of La Rioja, and unites with the Guaducol, from the west, to form the Bermejo, which, after a southern course through the province of San Juan, is lost in a great swamp, in lat. 32°, which finally drains into the river San Juan. At about 31°, it has a branch from the north-west formed by the union of many streams from the Andean valleys. The San Juan represents the drainage from the gorges of the Cordillera lying between 30° 30′ lat. and 32° 30′, which, at Calingasta, concentrates into a single channel and runs south-east to the lagoons of Huanacache, which, swollen also by the waters of the Bermejo, finds an outlet into the river Desaguadero, running directly south towards the Colorado. *En route*, the Desaguadero has no tributary from the east, but from the west it receives the Tumunyan, the Diamante, and the Atuel, all of them long streams, into which pour numerous water-courses which violently descend the Andes. The Desaguadero, under different names, finds its way into the great swampy lagoon near 38° of latitude, known as the Urre Lauquen. In their long course through a desert district, where the evaporation is immense and the land insatiably thirsty, the great volume of water which the rivers of this basin collect and send southward only reaches the Urre Lauquen as a feeble stream. It formerly joined the Colorado by a channel yet visible, and, it is said, still used in exceptional floods. Thus the Colorado is cut off from the greater part of its natural basin by a region which is apparently growing drier and more arid, and the river is now dependent for its flow upon its head branches, the Grande and Barrancas, streams which collect the drainage of many inter-Andean valleys, and use the Colorado simply as a canal to send it south-east to the sea. This canal receives no tributary in its long course from the foothills of the Cordillera. In the rainy season, it is a quarter of a mile wide, but, in the dry one, shrinks until it is easily fordable. The rivers of the entire Colorado basin are useless as commercial avenues. The contour-lines around the lower Colorado indicate that the river once emptied into a broad, shallow estuary which penetrated inland from the present coast-line about 116 miles. It probably included the present Bahia Blanca and its northern coast as far as Mount Hermoso.

Bahia Blanca is the natural emporium for all this inter-Andean region. It also seems destined to control the export and import trade of at least one-half of the fertile province of Buenos Ayres and of the whole of the valley of the Negro, the upper portion of which is a region of great agricultural and pastoral possibilities. The distance to the sea from the central city of Cordova is the same through Bahia Blanca as it is through Buenos Ayres and the Plata estuary, while Bahia Blanca, so easily accessible from the ocean, is the deepest and best harbour between Brazil and Patagonia. Evidently, therefore, this fourth doorway to the interior of the continent has an important future.

PATAGONIA.—Palæontological discoveries in Patagonia appear to confirm the contention of some scientists that South America is but the outlying remnant of a vast antarctic continent, of which South Africa, Australia, and New Zealand formed a part. It is claimed that they share certain of their fauna in common. A striking example is the discovery recently made by one of Dr. Moreno's assistants (Mr. Roth, of the Plata Museum), who, in 1897, found in the upper Cretaceous beds of Patagonia, near Lake Musters, a caudal sheath-ring, very similar to that of the great Pampean glyptodon, but which Dr. Moreno refers to a form like the Pleistocene Chelonia, called the Miolania, from Queensland and the Lord Howe islands. Very recently Mr. Roth has found other portions of the same animal, including its complete skull. These original remains are so astonishingly like those from Queensland, at the British Museum, that their close alliance is evident, and any difference apparently only specific. Taking into consideration the incalculable lapse of time which separates the Australian Pleistocene specimen from the Patagonian Cretaceous one, the form has been maintained with remarkable persistency. If experts confirm Dr. Moreno's opinion that the two skulls belong to the same genus, it will go far to prove the theory that South America and Australia were once connected by land.*

Until the great expedition of Fitzroy and Darwin attracted the attention of the world to Patagonia in 1832, its interior was a geographic mystery, the one ray of light being the voyage of Viedma up the Santa Cruz river to Lake Viedma in 1782. Even the description of the *rio* Negro by Padre Falkner, published in 1775, was based on *data* derived from the Indians, and from information given by the Chilian missionaries who had penetrated to its headwaters from the Pacific side of the continent. But, in 1869 and 1870, the voyage of Captain Musters through the heart of Patagonia awoke the dormant spirit of exploration, and, in 1873, both the Chilian and Argentine Governments organized expeditions to examine the *terra incognita;* the former sent Captain Simpson from the Pacific side, and the latter Dr. Moreno from the Atlantic. Since then, the interior has been extensively explored, the western slope by Chilian scientists, notably by Dr. Steffen, and the eastern by Argentine ones, especially Dr. Moreno. They have greatly enriched our previously meagre knowledge of the country.

Patagonia extends from the *rio* Negro to the Straits of Magellan on the Atlantic side, but, on the Pacific coast, it commences only at about 41° 30′ lat., where the central valley of Chile is submerged by the channels which wash the base of the Andes. The physical characteristics of the two sides have a marked contrast except near the summits of the

* Dr. H. O. Forbes, in his lecture before the Royal Geographical Society on the Chatham islands, roughly outlined the supposed ancient antarctic continental area. See Supplementary Papers, 1893.

Cordillera. The lands immediately south of the Negro are very similar to those lying between it and the Colorado and the inter-Andean district south of Mendoza. Between Bahia Blanca and the Negro on the Atlantic border, tertiary rocks commence to appear covered by extensive sand-dunes. A bed of sand and clay covers the soil, and, advancing south, the Patagonian shingle formation appears. Just south of the mouth of the river Negro, commences an immense belt of grey and yellow tertiary cliffs from 120 to 300 feet high, which continue to border the Atlantic coast as far south as the Straits of Magellan. These tertiary layers extend inland, gradually rising to the foot of the ridges which precede the Cordillera of the Andes.

The powerfully eroded longitudinal section of the Andes contains immense valleys frequently holding lakes of an Alpine character, some of which reach even to the western border of the tableland. Many of these, even though lying to the east of the Cordillera, find their outlet to the Pacific ocean through deep gaps of the mountains, while others send their waters through transverse depressions to the Atlantic. It is notable that where a large lake or a group of small lakes exists on the eastern slope of the Andes, transverse depressions are also found, which, in former times, were their drainage channels to the east. When, in a recent geologic period, rivers running west through the Andean gaps have captured any lakes, the valleys which these once occupied are dry, and contain only a stream or river of minor importance.

Following up the most northern of these depressions, north-west from the Atlantic, we find it developed between low cliffs which border the tableland. It is occupied by the *rio* Negro, which is formed by the junction of the rivers Neuquen and Limay, near long. 68° W. The former descends from the north-west, draining a rough and much broken country with many small existing lakes and the remains of many great ones which once watered extensive regions which are now barren. The river Limay, from the south-west, has its headwaters among the Patagonian Alps, the magnificent scenery of which is singularly wild and attractive. Ascending the river, and crossing its gorges and barren lands, the country becomes more and more broken, and the plateau is covered with basaltic lavas and granitic masses. At length the Collon-Cura, the principal affluent of the Limay, is reached. In common with the Bio-bio, it drains a vast lacustrine depression, the Collon-Cura taking the southern remains of the former great lake, and the Bio-bio the northern, intersecting the Cordillera and emptying into the Pacific. To the west of the Collon-Cura are a number of small lakes of great beauty. In lat. 41° we reach Lake Nahuel-Huapi, with its tributary lakes Correntoso and Espejo, a group of almost matchless magnificence. Lake Nahuel-Huapi is 207 square miles in area, and flows into the river Limay. Surrounded by large forests, it extends, in several deep fjords, into the very ridge of the Cordillera, while in contact

with it, to the south-west, is the gigantic Mount Tronador, with an immense glacier descending from basaltic cliffs. The wondrous beauty of this very extensive lake region is in bold contrast to that lying between the river Limay and the Atlantic ocean, and bounded on the north by the *rio* Negro; for, on this tableland, we find hollows containing salt deposits and ancient west-to-east channels of lost rivers, and here and there a small hill but no important stream. These dreary, barren lands, called the Huincul-Mapu, consist of shingle, with a little coarse grass and a few shrubs. To the south, is a low group of highlands, which seem to be a reappearance of the Argentine Cordoba range. The plateau from which they rise is capped by the black lava which renders so large a part of central Patagonia of little value.

Padre Falkner's work upon Patagonia led to the exploration of the *rio* Negro by Villarino, under orders from the Spanish Government. In 1782, he ascended it with four well-equipped launches. With immense difficulties from the very start, he succeeded in reaching a point at its headwaters 525 miles from the sea by the curves of the river, the result being a practical demonstration that it is of very little use for commercial purposes.

Between the Negro and the Chubut can be traced a great transverse depression, now dry, from the bay of San Antonio to the lake Nahuel-Huapi, through which the lacustrine system of North-Western Patagonia probably once drained to the Atlantic. The Chubut runs in an apparently eroded valley eastward from the Andes, among the foothills of which rise the rivers Maiten and Tecka, which unite to form it. The entire region traversed by it is barren and useless. It is a rapid, crooked stream of irregular depth, and carries but little water.* Its lower course, at its mouth, is only about 130 feet wide, and admits vessels drawing 7 feet of water, which can penetrate but a few miles inland. Above its mouth, the river runs through a valley which opens to a width of 6 or 7 miles for a length of 45 miles. It is margined by cliffs about 300 feet high, which are at times escarped and then again of easy slope from the edge of the barren tableland. This is the fertile valley of the Welsh settlers, which, however, yields its products only to irrigation.

The Andean slopes, south of the river Tecka as far as 46° of latitude, are drained by a number of streams which flow into and form lakes Colhue and Musters, which drain north-east into the Chubut, and which are the remains of a former lake of much greater extension. The principal of the above streams, the Senguerr, runs across the eroded tableland extending between the hills of Tepuel and Omckel and the most eastern Andean mountains. In these tablelands, which are from 2300 to 3000 feet in height, is the continental *divortium aquarum* to the

* See 'Viaje à la Patagonia Austral,' por F. P. Moreno.

east of the Cordillera of the Andes. The northern part of the district is drained through a break in the mountains to the Pacific ocean by the river Fetaleufu, and the central part drains westward through the Cordillera to the rivers Palena and Cisne. South of the Chubut, as far as the parallel of lakes Colhue and Musters, the country, from the coast to the foot of the Andes, is a vast shingle-covered plateau, with table-hills and ravines, the beds of extinct rivers, barren cliffs, and immense extensions of black lava.

South of the river Cisne is a group of mountains holding lakes La Plata and Fontana; and, south of these, a transverse depression extending from the Pacific to the Atlantic, the eastern part draining to the latter ocean, and the western to the former through the river Aisen and its affluents.

Lake Buenos Ayres, the largest in Patagonia, is 712 feet elevation, and lies between lat. 46° and 47°. In very recent times, it sent its waters to the east, but they are now diverted to the west through another great interoceanic depression. Towards the Atlantic it was drained by the now unimportant river Deseado, which enters the sea at Port Desire. Its Pacific outlet is by the river Las Heras, which also drains lakes Soler, Brown, and Pueyrredon into the immense fjord, at lat. 48°, called Calen inlet. The Las Heras is a violent stream with many rapids and obstructions.

South of the Deseado, there is no river of importance until the Santa Cruz is reached, although the intervening plateau is carved with hollows and gorges. The tops of the existing table hills are generally capped with lavas.

There is another group of lakes called Volcan, Belgrano, Azara, and Nansen, the surplus waters of which once flowed eastward to the Atlantic, but now have their outlet into the northern arm of the *rio* Mayer, which has been diverted to the west, and winds through the mountains to empty into the large lake San Martin, which, in turn, finds an outlet across the Cordillera into Calen inlet by the river Toro.*

The *rio* Chico branch of the Santa Cruz, which rises between great lava-streams near Lake Quiroga, was once an important stream, but is now of shrunken proportions, and its wide valley is filled with detritus and enormous erratic boulders. A short distance above its mouth is the almost lost river Shehuen, which has excavated a deep bed in the basaltic lava and runs east from the vicinity of lakes Viedma and San Martin, both of which it once drained. The large area of country lying between the Chico and the Shehuen is the most mournful of Patagonia, and is covered almost totally by basaltic lavas.

The great, deep lakes Viedma and Argentino lie, the one to the north, and the other to the south of lat. 50°; they find an outlet to

* See "Explorations in Patagonia," *Geographical Journal*, 1899, by Dr. Moreno.

the Atlantic by the tortuous and reef-obstructed river Santa Cruz to Port Santa Cruz. The river is navigable for light craft during flood time. To Gardner, in 1867, fell the good fortune of discovering the beautiful lake Argentino, afterwards so named by Moreno; and Thomas Rogers, of the Chilian navy, while engaged in his valuable explorations of the south-west coast of Patagonia, also penetrated to it across the Andes.

The only river of any importance between the Santa Cruz and the Straits of Magellan is the Gallegos. It is a short stream, of no value for navigation, and flows from its sources, of little elevation, through a country covered with basaltic lava and shingle.* Ramon Lista † gives an interesting description of the country lying between the Santa Cruz river and the Straits of Magellan, much of which is adapted to pastoral purposes. Aside from the region of the north-western lakes, it is probably the most promising part of Patagonia for settlement.

The great antarctic Humboldt current finds its way northward along the west coast of Patagonia, while on the Atlantic side the equatorial current sets southwards, so heated that, on any parallel of latitude between the Plata river and the Straits of Magellan, it is six degrees warmer on the Atlantic side of the continent than it is on the western side. In consequence, the colder atmosphere of the Pacific coast rushes eastward, increasingly congealed, through the wide glacier-filled valleys of the low Patagonian Cordillera, to fill the vacuum created by the heated belt on the eastern slope of the mountains. The result is an abundant rainfall, and that long series of lakes, thirty to forty in number, nearly all of which lie along or near to the 72° of west longitude. These not only collect the storm waters, but the flow from the glaciers and melting snows.

The Straits of Magellan, which have played such a prominent *rôle* in the commercial history of South America, are 240 miles long from entrance to exit, in a straight line, and 310 miles measured by their windings. The tides at the Atlantic end rise from 36 to 44 feet, and at the Pacific only 4 feet. Such a difference occasions great perturbations in the currents, which, through the narrows, run from 5 to 8 knots an hour. Along the eastern 100 miles, as far as Cape Negro, the land is low and treeless, but the country further on gradually swells into highlands, until at Cape Froward it becomes mountainous and thickly forested, remaining so to within 100 miles of the western entrance of the straits. For this last stretch, however, the forests gradually merge into scrubby bushes, which finally disappear, leaving the rocky hills and mountains bare of vegetation except deep beds of saturated moss and a few stunted bushes, which cover their lowest slopes or fill their ravines and gorges.

* See 'Patagonia Austral,' por Carlos M. Moyano.

† 'Mis Esploraciones y Descubrimientos en La Patagonia, 1877–1880.'

Cape Froward, in lat. 53° 34′ and long. 71° 18′ W., is the extreme southern point of the continental land, and is about midway of the straits. To the eastward of this cape, it is possible to tame down the country to the use of man; but, west of it, there is nothing but savage hills and mountains, from the slopes of which glaciers descend almost to the sea.

The Pacific ocean seems to have selected the western half of the Straits of Magellan as the focus of its most furious and enduring gales. They whirl through it almost incessantly, and, with violent squalls and driving rain and snow, add their contingent to the many other obstacles which beset every sailing ship which ventures the transit from east to west.

An archipelago is separated from Patagonia by this mighty rent in the Andes. The largest of its many islands is Tierra del Fuego, having an area of 20,000 square miles. It presents an unbroken Atlantic coast-line to its south-eastern terminus, at the Strait of Le Maire. The island is similar in character to the hilly, mountainous country of south-western Patagonia, and its southern part has a range of wooded mountains and highlands descending north and east into hilly and rolling plains covered with succulent grasses—a good pastoral region.

South and west of Tierra del Fuego, as far as the Pacific entrance to the straits, are the last vestiges of the Cordillera of the Andes. They are torn through in all directions by the ocean, and are hilly, rocky, mountainous, forbidding and inhospitable in aspect, cut by tortuous, deep fjords and channels, and dominated by snowy crests and peaks, which send numberless glaciers into the gorges and valleys. The whole line of islands forms a gigantic, precipitous bulwark, a series of forts protecting the southern end of the continent from being torn away by the destructive force of the ocean waves, which the violent and almost continuous western and south-western gales savagely hurl against the barrier, forcing it to slowly yield. Saturated and sleet-laden clouds drive through the valleys and along the mountain slopes, which, up to the low snow-line, are generally clad with matted vegetation and deep beds of moss which cover a flooded soil.

My analysis shows that, in general, man finds himself confronted by severe conditions in his struggle with nature in South America. Thus far, however, his efforts to develop and utilize its vast resources have made its commercial history an epic. The thought naturally presents itself, that had North America fallen to the lot of the Latin race in the European occupation of the New World, and South America to the Anglo-Saxon, the former might still have maintained its old supremacy; for the more rapid progress of the latter may not be due so much to racial superiority as to advantageous geographical surroundings.

The CHAIRMAN (Colonel Sir Thomas Holdich, Vice-President): It is with very much regret that I have to state that through illness our President will not be here to-night. His absence is all the more to be regretted because he is personally familiar with that country about which we are to hear. It is, as it were, his own happy hunting-ground, and his remarks and criticisms on the paper that is to be read would have been most valuable and interesting to us.

I have to introduce Colonel Church. No introduction is really necessary, for he is a very old friend. As a traveller and explorer who has wandered, as he says, through pretty nearly every mule-track of South America, and as a gallant soldier who led a brigade at the early age of twenty-seven during that war which some of us may remember—the Civil War of America—he is always a welcome addition to our circle here. To-night, I claim your attention to him as a traveller and as a very close and faithful observer of men and things. I will not waste further time with any preliminary remarks. I will call on Colonel Church to read us his paper.

After the reading of the paper, the CHAIRMAN said: There must be several gentlemen here who are more or less acquainted with those regions of which Colonel Church has just been telling us, and we hope they will add to the interest of the evening by assisting in the discussion.

Mr. E. J. PAYNE: I think the first thing we should do is to join in the feeling to which you gave expression in your opening remarks at the absence of our learned President. Sir Clements Markham, I believe, received his first stimulus to geographical study in his early travels in Peru, and we all regret that he is not here to say what we should have been glad to hear him say on the paper. Sir Clements Markham has studied the Andes in all their aspects; he has travelled through every part of Peru; he has studied the language; and we shall all, I am sure, join in your regret, Mr. Chairman, that he is not present to give us the benefit of his criticism on Colonel Church's paper. But I do not think there is much in the way of criticism to be said. We have all listened to the paper with a feeling of admiration and of wonder at the immense amount of knowledge which Colonel Church possesses of the South American continent. There is not a mountain, there is not a river, there is not a plain, there is not a portion of the sea-coast, there is not an estuary in the South American continent, of which Colonel Church is not prepared to give us full particulars. He can tell us how many tons of silt every river brings down; he can tell us the height of the tides at every part of the coast, as well as the heights of all the mountains; and I am sure he has thrown the greatest interest over every feature he has put in his paper. I have sat at his feet for years, and I have listened to-night with deep interest to his lucid and eloquent exposition of the physiography of South America. I believe he was the first to explain in the *Journal* of this Society the way in which the Caribs explored the northern coasts of South and Central America, the West Indian islands, and probably ascended the Mississippi. He also discovered and communicated to the Society the ancient Moxos lake and the Pampean sea, the shore of which we believe to have been the original dwelling-place of the Incas; in fact, there is no part of this portion of the world on which Colonel Church has not thrown great light, and I am sure we have been deeply interested with his very lucid explanation of the geographical configuration of the continent. Never having been in South America myself, I do not feel that I can usefully add anything to what he has said in his paper. I am sure we are all looking forward to seeing the palæontological remains which have been brought here for our inspection, and I think we shall be anxious to shorten this part of the proceedings as much as possible in order to hasten to see them.

The CHAIRMAN: I think we are honoured by the presence of the Bolivian Minister, Señor Aramayo. Perhaps he will kindly favour us with a few remarks.

Señor ARAMAYO: I am not prepared to make any criticisms on the interesting address we have heard to-night; but I avail myself with much pleasure of this opportunity to acknowledge the admiration with which I have listened to Colonel Church's exposition of the geography of South America, of which he has acquired such extensive knowledge during his long stay and repeated travels, having at his command a rare spirit of scientific observation and the most commendable perseverance. I wish to express more particularly my thanks to him for having brought to the notice of this learned Society his knowledge of the topography and resources of that portion of the South American Continent which is comparatively so little known, and which is my own country—Bolivia. I am sure there are very few Englishmen or Americans who know that country so well as Colonel Church, but since the time of his visit a good deal has been advanced in the way of scientific investigation, and I have the satisfaction of informing the President that in the course of a few days I shall have the honour of presenting the Society with a map of the northern part of Bolivia, which is the result of various explorations carried out under the auspices of the Government. This map has been prepared by General Pando, the President of the Republic, who personally explored the region crossed by the rivers Madre de Dios, Inambary, Tambopata, Heath, and others. I may add that the present Government of Bolivia are making every effort to extend their explorations to all those parts of the national territory which are still unexplored, which will contribute to make the country better known in the scientific world. The military expedition to the River Acre, lately carried to a successful issue, will throw a great deal of light on that valuable territory. Another expedition is now ready to start from Pará to the sources of the Javary with Mr. Satchell, an English engineer in the service of Bolivia, as the technical chief. In the month of November last an exploration was also made, at the expense of the Bolivian Government, on the river Paraguay as far as the Laguna Gaiba, with satisfactory results, by Captain Bolland of the English Navy. All this will show that we are contributing our share and making every effort to forward a knowledge of these unexplored regions of South America.

The CHAIRMAN: There is another gentleman present who has considerable acquaintance with South America, I think—Mr. Howard Saunders. Perhaps he will favour us with his views.

Mr. HOWARD SAUNDERS: I am afraid that I can say little of importance about the very interesting lecture that we have heard, except to express my great admiration for the manner in which Colonel Church has given us his opinion upon the general configuration of South America, and the channels for communication and trade with the interior. He has not alluded this evening to a subject upon which he made a considerable mark a few years ago at the meeting of the British Association at Bristol—a vast estuary or lake which ran, at one time, nearly to the headwaters of the Paraguay. If Colonel Church did allude to it, I unfortunately missed it; but it is an interesting fact that an immense estuary existed, and Colonel Church has distinctly proved that it covered a very large portion of the headwaters of the Paraguay. Only a very small tide went up the lower portion of the estuary, which we now know as the La Plata, and there is a remarkable fact connected with its existence, in the coincident localization of a water-bird, the "rayador," which is well known in South America. It has this peculiarity, that the under mandible is very much longer than the upper portion. There are five species of these skimmers (*Rhynchopinæ*): one found in Asia, one in Africa, one in North America, one on the Pacific coast of South America and along the Amazon valley, and then this one, which is found only, as far as we know, in this great inland sea, or over the rivers which now drain what was the great inland sea.

With regard to the traffic and communication, I fully agree with Colonel Church in what he has said about the impracticability of carrying out any important communication over the Andes from the Pacific. Nobody who has not crossed the Andes can realize the difficulties of traversing those mountains. They are widest in about lat. 20°, and to the northward the ranges are exceedingly steep, and there are no roads. In crossing the Cordillera you have to dodge the two wet seasons, and these do not coincide. The object is to cross the western range at the time the rains are nearly over, and then reach the second range before the rains commence there. Then of course comes the question of getting down the rivers, which is always a very difficult one. I am glad to hear that steamers have actually reached the foot of the Pongo de Mansericho in Peru, because that is the place to which I directed my attention a good many years ago, being anxious to find out whether that obstacle to navigation could be blown up, and if so, how far navigation could be carried beyond it. I quite satisfied myself that on the Marañon, above that fall, there were so many more rapids that, even if the main Pongo were blown up, very little advantage would follow. There is little more to say, except to express my great esteem for Colonel Church's paper.

Colonel CHURCH: In view of Mr. Saunders' remarks will you excuse me if I take up one more minute of your time? [Here Colonel Church gave an outline of the Amazonas lake, the Mojos lake, and Pampean sea as described in his paper, pp. 385 and 387.]

The CHAIRMAN: More than ever do I echo the sentiments expressed by Mr. Payne of regret at the absence of our President to-night, and deplore my own ignorance of the geography of South America; but I must, however, acknowledge the efforts that have been made by Dr. Moreno on the part of Argentina, and Señor Bertrand on the part of Chile, to correct those deficiencies. I hope to know something more about it in time. There is, however, one point on which I can challenge Colonel Church's conclusions. He has spoken of Lake Titicaca as the highest lake in the world. Now, as the self-constituted champion of Asia, I know of one lake which bears the name of our late beloved Queen which is at least a thousand feet higher than Titicaca, and I think I know others that may be higher; but they all bow their heads to Lake Victoria. These, however, are matters of detail, and I think we can all agree to join in a cordial vote of thanks to Colonel Church for the lecture which he has delivered, not only in an interesting, but in a most attractive, manner. I trust that hereafter we shall hear something more of South America from him.

NOTE ON TOPOGRAPHICAL WORK IN CHINESE TURKESTAN.

By Dr. M. A. STEIN.

IN June last I was able to start, with the assistance of the Indian Government, on a tour of archæological exploration in Chinese Turkestan. The necessity of fixing accurately the position of ancient sites and of collecting fuller materials than hitherto available for the study of the historical topography of this region brought surveying operations into close connection with my immediate task. But from the first I was anxious also to utilize whatever opportunity the journey might offer for topographical work of a more general character. In

order to assist me in this direction Colonel St. G. Gore, R.E., Surveyor-General of India, very kindly agreed to depute with me one of the native sub-surveyors of his department, and to provide all necessary instruments. M. Ram Singh, the sub-surveyor selected, had accompanied Captain Deasy during his recent explorations in Chinese Turkestan, and was thus specially qualified to render useful services. In the present note I wish to give a brief preliminary account of the topographical work so far effected in connection with my tour.

The Government of India having allowed me to use the Gilgit-Hunza route for the journey to Kashgar, I reached, at the close of June, Chinese territory on the Taghdumbash Pamir by the Kilik pass. A plane-table survey, on the scale of 8 miles to the inch, was there commenced and carried down to Tashkurghan, and hence to the Sarikol valleys west of the Mustagh-ata chain. It was supplemented by triangulation, based on the points supplied by the Pamir Boundary Commission's and Captain Deasy's surveys, and further by photogrammetric work, for which I was able to utilize a Bridges-Lee photo-theodolite, kindly lent to me by the Indian Meteorological Department. Special attention was paid here, as well as along the routes subsequently followed, to the local nomenclature. In Sarikol frequent doublets of local names were noted, which curiously reflect the mixture of Iranian and Turki elements in the population, and also account for the variations in earlier traveller's records. In the matter of historical topography, it may be of some interest to note that the localities visited by Hiuen Tsiang, the famous Chinese pilgrim of the seventh century, on his passage through these mountains could be traced with certainty. The evidence thus obtained distinctly supports the identification of Tāshkurghan with the λίθινος πύργος of Ptolemy.

From the spurs of Mustagh-ata the triangulation was extended to the great glacier-crowned ranges to the north and north-east overlooking the "Little Karakul" lake and the valley which drains it. The slopes of the "Father of ice-mountains" itself supplied a series of splendid survey stations, the maximum elevation reached being over 20,000 feet on the ridge that flanks the Yambulak glacier from the north. This ridge in the summer of 1894, when Dr. Sven Hedin made his ascents, was almost bare of snow. In July last it was found to be covered from *circ.* 15,500 feet upwards with heavy masses of snow, which greatly impeded the ascent. They seem to have been accumulating for the last two or three years, and may gradually transform themselves into an ice-mantle such as lies over the other elevated slopes of the great mountain. The weather was by no means favourable, else the attempt might have been made to reach the col that divides the heads of the Yambulak and Kampar-Kishlak glaciers at a height of about 23,000 feet below the northern summit.

The route from the Mustagh-ata region down to the plains of

Kashgar lay through the Gez defile. As its lower portion was rendered impassable by the summer floods, it was necessary to take to the track across the series of transverse spurs known as "Tokuz-Dawan" ("the nine passes"). These marches were trying to man and beast, but afforded opportunities for mapping also the little-known eastern slopes of the great snowy range north of Mustagh-ata.

The excursions which I made during a longer stay at Kashgar to various ancient sites in the vicinity, were utilized also for survey work. A couple of clear days, such as rarely fall to the surveyor's lot in the dust-laden atmosphere of Eastern Turkestan, made it possible to sight again the series of great snowy peaks previously triangulated from the neighbourhood of Mustagh-ata. It may be hoped that these observations will be useful for the final determination of the exact longitude of Kashgar.

In September I marched to Yarkand by the route which crosses the tract of moving sands around the shrine of Ordam Padshah. Our plane-table survey checked by astronomical observations indicates for this curious locality a position differing not inconsiderably from that in earlier maps. From Yarkand to Khotan I followed the great caravan route leading along the edge of the desert. In view of the historical importance attaching to it as the great thoroughfare by which, in earlier times, the trade from China to the Oxus region and the far West mainly passed, it may be noted that I was able to trace a number of ancient sites along it, and in particular to identify those named by Hiuen Tsiang in connection with his return journey from India. In regard to these and to the various localities in the Khotan district which the pilgrim visited and described in his 'Records of the Western World,' his guidance has proved quite as accurate as we are accustomed to find it on Indian soil.

The Khotan oasis and the desert region near it have in recent years furnished so many finds of great interest to the student of Indian antiquities and of Buddhism that it was necessarily from the first singled out as the special field for my archæological work. The longer stay implied hereby, and in particular a delay necessitated by preliminary arrangements for the exploration of certain desert sites, have permitted me to devote also some weeks to a geographical task of special interest. Our knowledge of that portion of the Kuen-luen range which contains the headwaters of the Yurung-Kash or Khotan river, has so far been very scanty, having been practically restricted to the sketch-map illustrating the route by which Mr. Johnson, in 1865, had made his way down to Khotan. Colonel Trotter, of the Survey of India, in his report on the topographical work of the Yarkand Mission of 1873, had already expressed the belief that the headwaters of the Yurung-kash were much further to the east than shown on that map, and probably identical with a stream rising on the high plateau south of Polu. Captain

Deasy, working from the side of Polu in 1898, succeeded in reaching this stream at an elevation of close on 16,000 feet, but was prevented from following it downwards. Thus the true course of the main feeder of the Yurungkash, where it cuts through the Kuen Luen range, together with most of the orography of the surrounding region, still remained to be ascertained.

In view of the close approach of winter, I set out for this task as soon as possible after my arrival in Khotan. Fortunately, no objections were raised by the Chinese administration to exploration in that direction, though at one time it had looked as if there were reason to apprehend them. On the contrary, Pan Darin, the Amban of Khotan, did all in his power to facilitate the arrangements for transport and supplies, and subsequent experience has shown me that without this ready assistance the tour through these mountains would probably have proved impracticable. I owe this and other valuable help rendered by Chinese officials undoubtedly to the kind offices and the influence of Mr. G. Macartney, C.I.E., the representative of the Indian Government at Kashgar.

The valley of the Yurung-kash becomes impassable within a day's march from its debouchure into the plains. Hence the route from Khotan to Karanghu-tagh, the southernmost inhabited place, leads over a series of ranges that separate side valleys draining from the east. On the first range crossed by the Ulugh-dawan at an elevation of *circ.* 11,300 feet, the effects of the dust haze rising from the desert plains were still too marked to permit of any distant view. But already from the next range, above Buya, a very extensive panorama was obtained. In a grand glacier-girt mountain, rising in solitary splendour to the south-east, it was impossible to mistake the "Kuen-luen Peak No. 5," already triangulated from the Ladak side, and marked in the tables supplied by the Survey Department with the height of 23,840 feet. The few Taghliks in the neighbouring valleys know no other name for it than Mustagh, "the ice-mountain." South of it there stretches a magnificent range of snowy mountains, forming the watershed towards the western-most portion of Aksai-chin plateau. Its crest-line seemed nowhere to fall below 19,000 feet, but none of its peaks can rival the grand cone of "Kuen-luen No. 5." It soon became clear that the main Yurung-kash stream has cut its way between this great peak and the range that is flanked by it on the east.

On the last of the outer ranges, above the Pisha valley, an excellent station was found, at a height of *circ.* 13,400 feet, for surveying the valleys of the numerous glacier-fed streams which join the main Yurung-kash river from the south. Their courses, as well as that of the main river, lie in deep rock-bound gorges flanked by spurs of remarkable steepness. Owing to the rugged nature of the ground, the descent to the Yurung-kash was exceptionally trying, and almost impracticable

for the baggage. Fortunately it was possible to replace the ponies by yaks at Karanghu-tagh, a small settlement of Taghlik herdsmen, which also serves as a penal station for select malefactors from Khotan. It would be difficult to find a bleaker place of banishment. The Kash river, on which Karangu-tagh lies, comes from a series of magnificent glaciers below peaks that reach close to 22,000 feet, and carries a considerable volume of water to the main Yurung-kash, which it joins a few miles below the hamlet.

From Karanghu-tagh I endeavoured to follow up the gorge of the Yurung-kash as far as possible towards the east. The hillmen knew of no track leading to the head of the river; and, indeed, after a two days' climb over very difficult ground, a point was reached, *circ.* 79° 59′ 30″ long., 36° 2′ lat., where the river gorge, winding round the mighty southern buttresses of "Kuen-luen No. 5," becomes quite impassable for yaks and men alike. The spot is known as Issik-bulak, from some hot springs that issue from the rocks above the river-bed. Beyond this point, which is *circ.* 9000 feet above the sea, the river, unfordable even at this late season, fills completely the narrow passage it has cut through the rocks. No practicable track could be found along the extremely precipitous slopes that descend to the river from the high snowy ridges on either side. For an attempt at further exploration of the gorge, it would have been necessary to await the complete freezing of the river. But, though the temperature at night went down on October 27 to 16° Fahr., this eventuality could not be expected for another month. Even then I doubt whether a practicable passage could be found, considering the climatic conditions and the masses of fallen rock likely to be encountered. The uppermost portion of the river-course will, therefore, have to be explored from the south-east, where Captain Deasy appears to have found comparatively open ground near the source.

From the Karanghu-tagh valley I proceeded, on October 30, to the west, following the path just practicable for laden yaks, which forms its only connection with the outer world besides the route *viâ* Pisha. Two main transverse ranges are crossed by this track; they separate the Nissa and Chash valleys, both draining towards the Yurung-kash, and equally inaccessible in their lower portions. By camping near the passes it became possible to climb to excellent survey stations, particularly on the Brinjak ridge (*circ.* 15,300 feet elevation).

Beyond Chash the Yagan-dawan pass brought us to the drainage area of the lower Karakash river. Extreme disintegration of the rocks, aided apparently by peculiar climatic conditions, has produced here a perfect maze of deep-cut arid gorges, amidst which mapping was very difficult. Want of water also proved a serious obstacle. Fortunately, it was possible to arrange for the transport of ice from the Mitaz valley. The last pass to be crossed to the plains was the Ulughat-dawan, *circ.*

10,100 feet above sea, south of Popuna on the Karakash. Though much lower than the previously crossed ranges, it offered a more extensive view, which fulfilled a hope I had almost despaired of. It showed not only the whole of the ranges previously surveyed, but beyond them, towards the upper Karakash valley, many high snowy peaks previously hidden. Among them two peaks, already fixed by triangulation from the Ladak side, could be identified with certainty. These points, in conjunction with the "Kuen-luen Peak No. 5," made it possible to determine the position of the Ulughat-dawan station by theodolite, and to measure angles to all the prominent heights of the ranges within view.

Subsequently we succeeded in finding another high ridge to the east, which offered an equally extensive view, and where a second triangulation station could be established. We had climbed it just in time. While still engaged on November 10 at the height of Kaurukkuz, we saw a heavy storm from the desert northward pass over the plains. The dust-haze it carried along gradually enveloped the mountains, and further work became impossible. This fog-like haze, effacing all distant views, has since then continued to lie over the plains. But the prominent peaks in the outer range of hills immediately south of the town of Khotan, which have now been triangulated, are sure to be seen again in the course of the winter. This will complete the long-sought-for connection of Khotan with the trigonometrical system of the Indian surveys, and render the exact determination of its position possible.

CAN HAWKINS'S "MAIDEN LAND" BE IDENTIFIED AS THE FALKLAND ISLANDS?

By Commander B. M. CHAMBERS, R.N.

QUESTIONS connected with the discovery of the Falkland islands are, no doubt, of less general interest now than they were when Junius raised such a storm by his indictment of the Government of the day and their treatment of the Spanish claims. Still, to those who love the sea-lore of the past, and who care to follow the footsteps of the early voyagers—so in some measure sharing those delights of discovery and adventure denied to us, living at a period when all the world is but a tourist's highway—to these such a question as that heading this article is of perennial interest. In this paper I propose first to show that the evidence of Hawkins having ever visited the Falkland islands is entirely insufficient, and then I shall endeavour to substitute a theory to elucidate the seemingly inexplicable account of that generally accurate chronicler.

Let me first take the earliest available authorities as to the discovery

of the Malouines, and see on what grounds the claims of Sir Richard have been so generally admitted.

In Sir Clements Markham's 'Life of John Davis,' p. 127, I find—

"John Davis. . . . Driven in amongst certain islands, never before discovered by any known relation, lying 50° or better from the shore east and north-east of the straits.* . . . Davis saw a succession of barren hills sloping towards low broken ground and rocky surf-beaten shores, with quantities of drifting kelp on the surface of the sea, and great numbers of birds."

Now, this description gives an excellent idea in brief of the Falkland islands, and there is no reason for doubting that the Falkland islands were really seen by him.

Pernelty's 'Voyage to the Falkland Islands,' Introduction, p. 10, edit. MDCCCLXXI., in a note giving an account of Sebald's discovery in 1600, reads thus:

"At our landing we discovered three islands about half a league in length, pretty high, and forming a kind of triangle, agreeable to accounts of Sebald's Islands. . . . If these islands were really Sebald's Islands, they would be about two leagues distant from the land or principle island, not seven or eight, as Frezier says."

Now, here again we have the distinguishing feature referred to, many islands. I consider that Steeple and Jason islands answer fairly well to this description, and are exactly 7 leagues from the main. Elephant Flat and South Jason also meet the description, and are 3 leagues from Cape Terrible. In either case the triangles are not very clearly marked, but this would account for the differences of opinion here quoted. In the Falkland islands it is not uncommon, even on a fine day, for a mist to shut an island absolutely out of view which has been in sight a few minutes previously, and without having seen the island disappear, one would never suspect that anything was hidden. There can be no question but that Sebald's islands formed part of the Falkland archipelago, and my object in quoting these descriptions is to show that the first impressions of both these discoverers was, that of islands, an impression singularly absent from Sir Richard Hawkins' account.

Let us turn to Hawkins' observations. I have before me the 'Hawkins's Voyages,' edited by Sir Clements Markham (Hakluyt Society, 1878). On p. 188 we find—

"The wind continued good with us, till we came to forty-nine degrees and thirty minutes, where it tooke us westerly, being, as we made our accompt, some

* I am inclined to believe that this should read *in* 50° or better, from the shore east and north-east, since the actual distance from the westmost islands to the straits is about 265 miles, and the bearing, provided the change in variation has not been very great (it was 22½° E. in 1764), would agree with this somewhat vague estimate. The term "degree" seems to have, however, been rather loosely used: for Hawkins, just before sighting land on February 2, speaks of being some 50 degrees from shore. Pernelty speaks of Hawkins' discovery in 50° S. in '93 (? 94).

fiftie degrees from the shore.* . . . The second of February, about nine of the clocke in the morning, we descryed land, which bare south-west of us, which wee looked not for so timely; and coming neerer and neerer unto it, by the lying, wee could not conjecture what land it should be; for we were next of anything in forty-eight degrees, and no platt nor sea-card which we had made mention of any land which lay in that manner, heere about that height;† in fine, wee brought our lar-borde tacke aboard, and stood to the north-eastwardes all that day and night, and the winde continuing westerly and a fayre gale,‡ wee continued our course alongst the coast the day and night following. In which time wee made accompt we discovered well neere *three score leagues* of the coast. It is bold and made small shew of dangers.§

"The land is a goodly champion country, and peopled; we saw many fires, but could not come to speake with the people; for the time of the yeare was farre spent, to shoot the Straites, and the want of our pynace disabled us for finding a port or roade; not being discretion with a ship of charge, and in an unknowne coast, to come neere the shore before it was sounded; which were causes, together with the change of winde (good for us to pass the Straite), which hindered the further discovery of this land, with its secrets; this I have sorrowed for many times since, for that it had likelihood to be an excellent country.‖ It hath great rivers of fresh water; for the out-shoot of them colours the sea in many places, as we ran alongst it.

"It is not mountaynous, but much of the disposition of England, and as temperate. The things we noted principally on the coast, are the following: the westermost poynt of the land, with which we first fell, is the end of the land to the westwardes, as we found afterwards.¶ If a man bring this point south-west, it riseth in three mounts, or round hillockes; bringing it more westerly, they shoot themselves all into one; and bringing it easterly, it riseth in two hillocks. This we call point Tremountaine.

"Some twelve or fourteene leagues from this point to the east-wardes fayre by the shore, lyeth a low flat iland of some two leagues long; we named it Fayre Iland;** for it was all over as greene as any meldow in the spring of the yeare.

"Some three or four leagues easterly from this iland, is a goodly opening, as of a great river, or an arme of the sea, with a goodlie low countrie adjacent. And eight or tenne leagues from this opening, some three leagues from the shore, lyeth a bigge rocke, which at the first wee had thought to be a shippe under all her sayles; but after as we came neere, it discovered its selfe to be a rocke, which we

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* ? leagues, or is it possible he meant this to be his longitude. Early cartographists have placed the Falkland islands in from 40° to 50° west longitude.

† It is a curious thing that Pepys island should have been in 47°, not unlikely the same point.

‡ In early records this by no means implies excess of wind. In an old log of the battle of Beachy Head, I find the term "gale" occurring for a whole week in what was obviously fine weather.

§ See small chart. They could not have explored half this distance on the Falkland island north coast.

‖ I do not think there is even one moderately large stream running into the sea on the west shore Falkland island.

¶ There is a plate in Anson's 'Voyages of C. Blanco' in which three peaks are shown, but it is too indefinite to deduce much from.

** I do not know any island, either on the coast or islands, which meets this description.

called Condite-head; for that howsoever a man commeth with it, it is like the condite heads about the city of London.

"All this coast, so farre as we discovered, lyeth next of anything east and by north, and west and by south. The land, for that it was discovered in the raigne of Queene Elizabeth, my soveraigne ladye and mistres, and a maiden Queene, and at my cost and adventure, in a perpetuall memory of her chastitie, and a remembrance of my endeavours, I gave it the name of Hawkins Maiden land.

"Before a man fall with this land, some twentie or thirtie leagues, he shall meete with bedds of oreweed, driving to and fro in that sea, with white flowers growing upon them, and sometimes further off; which is a good show and signe that the land is neere, whereof the westermost part lyeth some three score leagues from the neerest land of America.*

"With our fayre and large wind, we shaped our course for the straites; and the tenth of February we had a sight of the land, and it was the head land of the Straites to the north-wards, which agreed with our height, wherein we found ourselves to be, which was in fifty-two degrees and forty minutes."

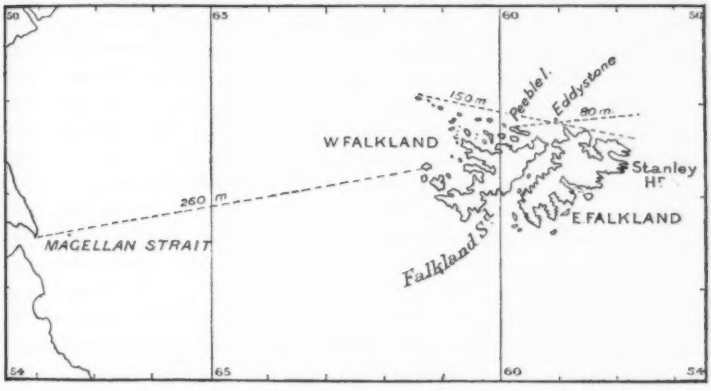


CHART SHOWING POSITION OF FALKLAND ISLANDS RELATIVE TO STRAITS OF MAGELLAN.

Here, then, is surely sufficient evidence to prove or disprove the statement, or, at least, a goodly array of facts on which to base our inquiry. Unfortunately, there is not available a map of the Falkland islands which is of sufficient size to clearly show all that we require. It is therefore necessary to turn to the Admiralty charts for information. The Admiralty charts 1354 *a* and *b*, obtainable from Messrs. Potter & Co., The Poultry, London, give all that is required, although the scale is over-large for reproduction.

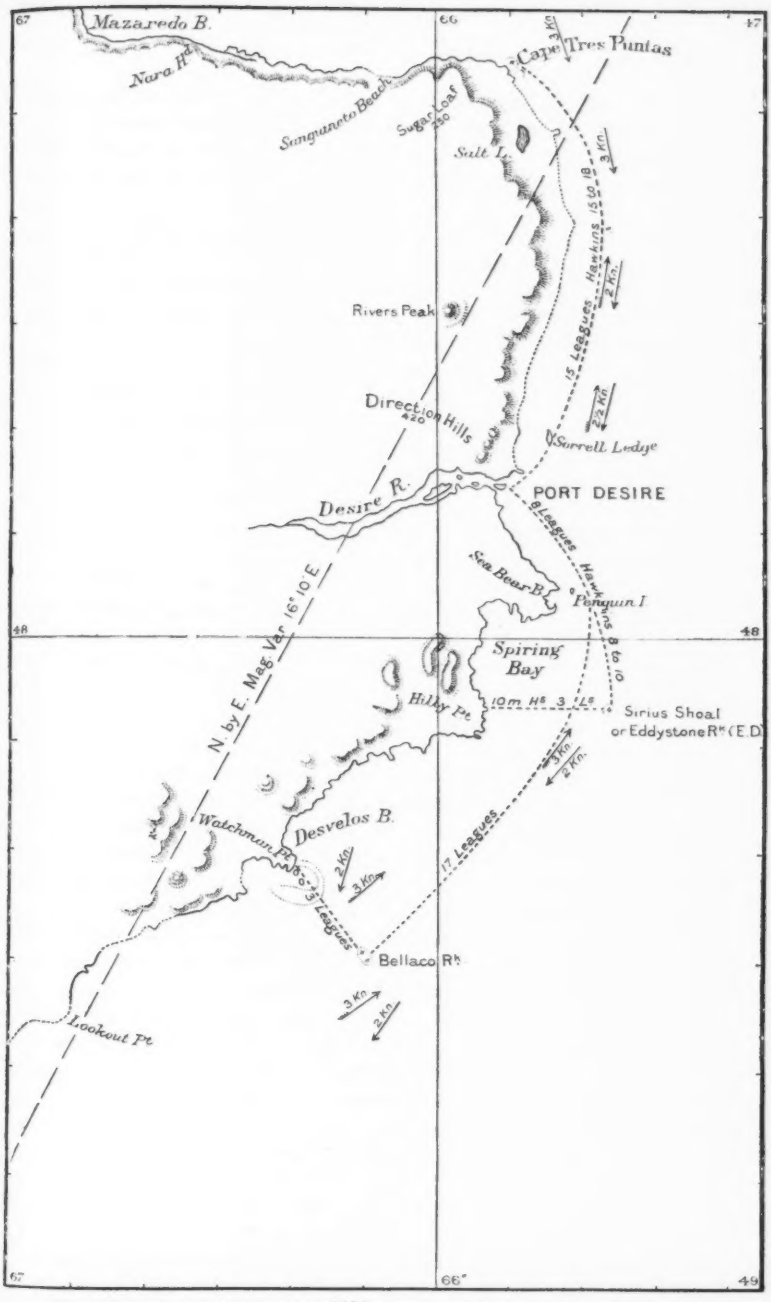
Let us first suppose that it was the north coast of the Falkland islands which Hawkins "descryed" upon the morning of February 2, 1592, and then, examining the chart, let us consider what he would

* On chart over 260, and the prevailing current would have seemed to make it more.

have seen had he really made the north-west point. The view from seaward would consist of a long range of high-peaked islands, stretching away to the westward. On the other hand, an upland mountainous country whose summits are generally swathed in the low-lying clouds of these regions. It is obvious that this will not meet the description of a low though bold and unbroken coast; the impression is more that of Davis and Sebald, islands everywhere. Running the eye along the coast-line to the eastward, whose general direction is, as Hawkins truly says, east and by north, the first piece of land which will even approximate to his description is Pebble island. This island contains three conspicuous peaks, and might be taken for part of the mainland if not too closely approached; but the eminences are rather fairly high hills than hillocks or little mounts, their heights being 790, 710, and 918 feet, otherwise their disposition agrees fairly well, for on a south bearing the three hills are clearly separated; from the east they would draw into line, though to bring this about the ship would be embayed in Falkland sound; whilst to see them at all from the westward, though two peaks only would show, I feel quite certain such a careful navigator as Sir Richard would never have brought "his ship of charge" into such a pass. Besides, he must then have seen the Port Egmont Cays and Keppel island. However, since we have no choice but to accept this island, let us suppose these other marks were hidden by a mist, so that Cape Tremountaine seemed the north-west point of the land, and let us continue with the description. Where is the low flat island 14 leagues along the coast to the eastward? Echo answers, where? There is not an island to answer the description, or indeed any island in the least resembling it along the whole length of the north shore. Such islands as there are are covered with high tussoc bogs, which might be taken for greensward afar off, but there are none on this part of the coast.

Falkland sound must answer for the goodly opening as of a great river; but I have never seen any discoloured water to speak of in a considerable experience of the Falkland-island coasts, and instead of being 15 to 18 leagues from the point of the three hillocks, it is but 9. It may be considered that this discrepancy is due to a current,* so let it pass. Of course the Condite rock could be nothing except the Eddystone rock, which does resemble a ship under sail, but this is only 4 leagues from the entrance to the sound at best, whilst it should be 10 leagues, and it is also too close to the shore. Where,

* It is obvious that Sir Richard, or rather his pilot, was not a good judge of currents, *vide* p. 174, where the author speaks of Ilha Grande being but some 12 or 14 leagues from Cape Frio. It is actually over 50 leagues, but the wind being light, and the current generally setting strongly to the west in the offing, we find this enormous error in a short distance. Hawkins's bearings are also generally rather vague throughout.



TRACING FROM ADMIRALTY CHART 1284. SOUTH AMERICA, SHEET X. (THIS SHEET IS SOMEWHAT SKETCHY IN ITS DETAILS, DATING FROM 1824.)

too, is our "goodly low countrie adjacent" to the opening of the great river? The land on each side of the sound is high and mountainous, 1220 feet, rising to 2000 on the one hand, and 700 rising to over 2000 feet on the other; this can hardly be said to fit by any manner of means.

Hawkins tells us that he explored threescore leagues of coast-line, but the coast of the islands which are available for exploration only amount to 30 leagues at best. Neither can the climate be said to resemble that of England in any way. If Hawkins remained upon the coast of the Falkland islands for more than a couple of days at most, I feel sure that he would have had cause to speak less kindly of the weather than he does. Turning to the 'Admiralty Sailing Directions' (South America), p. 16, chap. i., I find, "Wind is the principal evil at the Falklands; a region more exposed to storms both summer and winter it would be difficult to mention; the winds are variable, seldom at rest when the sun is above the horizon, and very violent at times. During the summer a calm day is an extraordinary event; generally speaking, the nights are less windy than the days: *but neither by night nor by day, nor at any season of the year, are these islands exempt from sudden and severe squalls, or from gales which blow heavily, though they do not last many hours.* The prevalent direction of the wind is *westerly;* gales in general commence at north-west and draw round to the south-west. The average velocity of the wind is about 340 miles, and the greatest velocity recorded during 24 hours was 999 on June 18, 1877, and the least 66, July 1, 1877."

These statements are not in the least overdrawn, and I much doubt that, had Sir Richard found himself as far to leeward of his correct course (ships should keep close to the land in making the straits), he would have ever made the straits with as little difficulty as he seems to have done, remembering that the ships of that day would probably not lie closer than seven points of the wind at best.

It may be worth mentioning here that the Falkland Island Company schooners, capital sailers, mostly ex-yachts, often take more than a week to make the west island from Stanley harbour.

As to the question of the latitude, Sir Richard states near 48°, though he gives the latitude of the straits almost correctly. We are told that this 48° should have been 50°; but supposing that both authorities are quoting from memory, I would prefer to trust Sir Richard, who certainly seems to have had a good memory for figures. To my mind, however, the strongest argument against the Falkland-island theory is that we hear nothing about the voyage returning along the coast. Let us suppose that the *Dainty* turned back soon after passing the Eddystone rock, and shaped a course for the straits with a wind "good for us to passe," how would it have been possible for her to have avoided passing through the Jason islands? and yet of this

we hear nothing. There is also the question of the fires and the actual seeing of inhabitants implied. The Falkland islands had no aborigines, and until the landing of the French settlers in 1764 there were no inhabitants whatever. In such a cold and moist climate, and where lightning is a rarity, there would be small chance of the grass taking fire, except as an extraordinary event, and yet Hawkins seems to speak of many fires; on the coast this lighting of signal fires has always been a characteristic feature. I fancy the impartial reader who has troubled to follow me so far will be fully convinced by this time that, whatever land Hawkins saw, it was not the north coast of the island. A very cursory examination of the chart will dispose of the question of its being any other part of the islands; indeed, I fancy it is only the difficulty of finding any reasonable supposition which has allowed the idea that Hawkins's "Maiden land" and the Falkland islands were one, to be adopted as one of the canons of nautical history.

The question now naturally presents itself, if not the Falkland islands, where was the land which Hawkins undoubtedly saw. It is natural to turn to the map of the coast, and in "next of anything" 48°, let us see what we find. Curiously enough, in lat. 47°·5′ S., lies a point,* —Cape Tres Puntas—which at once attracts attention by reason of its name, not less than its marked and salient position on the coast, for it is the commencement of an outlying flange which runs, not in truth east and by north, but north and by east, and is rather over threescore miles (not leagues) in extent. In the centre of this piece of coast, and just 14 leagues from Cape Tres Puntas, is the Desire river. Sir Richard's least estimate of the distance between the goodly river and the cape of three hillocks is 15 leagues, and the tides are strong on the coast. This coincidence is sufficient to attract attention at once.

Nearly 8 leagues from the Desire river lies the Serius, or Eddystone rock, which agrees almost exactly with Sir Richard's estimate. This rock, as its name would seem to indicate, was at one time of considerable height, and was marked as such in the old charts; it is now supposed to have become worn away by the action of the sea, and is a rock awash. Some authorities state that it is the same as the Bellaco reef, but this is doubtful; either position would agree as to distance from the shore, and the Bellaco resembles a ship under sail. But if the Bellaco be taken to be the Condite rock, some little adjusting of the distance run must be made to agree with the larger estimate of 10 leagues. Its actual distance is 17 from the Desire river; but, as I have before stated, Sir Robert was not great upon dead reckoning, and the currents are strong in that part, up to 3 knots an hour being experienced.

* See note Pepys island. Captain Cowley speaks of rocks and sand and spacious harbours in the lat. C. Blanco.

The coast in all this district is low and undulating, much what Sir Richard, who was more familiar with the south coast of England than the sterner northern parts of the British Islands, would consider "of the disposition of England." The weather is far milder than in the Falklands, and at that time it must have been well peopled by a race who delighted to raise signal smokes to attract the attention of passing vessels.

The question now arises where is Fayre island to be found? It certainly requires some stretching to believe that Sorell ledge, which occupies the position indicated with reference to the Desire river, can have been diminished by the erosion of the sea to this extent, though the changes which have taken place on this part of the coast are undoubtedly considerable—*vide* recent surveys of Port S. Julian as compared with those of Nasoa. It is, of course, also possible that the so-called island, the ship not being very near, and telescopes not yet discovered, may have been merely a strip of green sward upon the coast itself. There is no such strip on the west coast of the Falklands. As for Cape Tres Puntas, the Sailing Directions thus describe it: "Is the termination of a long range of tableland trending north and south; . . . the cape shows three distinct upright heads of a light earthy-coloured cliff." There would probably be plenty of discoloured water about, also kelp in the vicinity. One argument more before I come to my summing up. If this coast be followed for a distance of three-score leagues, and then course be set for the straits, the remaining distance will be just about as estimated by Hawkins—another three-score leagues, or 180 miles.

Of course, there are two obviously weak points in identifying this coast as Hawkins's Maiden land: first, it would be necessary to bring the ship to the wind upon the starboard tack (or right hand) instead of the "larborde;" and, secondly, the direction of the coast is W. by E., and not E. by W. My theory to account for these discrepancies is this. I believe that Sir Richard, being considerably out in his reckoning, had no doubt, when first sighting Cape Tres Puntas, that it was as he says, "a land not shown on any sea-card." As he followed the coast, I fancy a suspicion must have grown upon him as to the true facts of the case, but after having so far committed himself as to name the new land, we may feel sure he felt no desire to prove himself in the wrong.

When his crew, whose only knowledge was that they had sailed along a strange land to the east of the straits, returned home and told the story, the land would naturally be identified by the popular voice with that recently reported by Davis, and this identification was probably accepted by Hawkins without going deeply into the question of bearings and lay of the land, etc. When, in later years (probably twenty-five years after), Sir Richard wrote his observations, the general

trend of the land on the north coast of the islands was fairly well known. He may even have conversed with Davis or members of his crew.

It is hardly likely that many papers were brought to England by Sir Richard after his long captivity, and one can well imagine the aged seaman looking at a modern sea-card as he wrote his observations, and concluding that for once his memory must have played him false, as he substitutes the word "larborde" for "starborde," and "east and by northe" for north and by east, since, as he would no doubt say, "how could it be otherwise, seeing with a north-westerly wind we ran along this coast?"

I do not think that any one who knows the strange tricks which memory plays will disallow the possibility of this theory, which at least has the advantage of fitting all the curious corners of this otherwise inexplicable account.

SEBASTIAN MÜNSTER.*

By C. RAYMOND BEAZLEY.

This claims, apparently with justice, to be the first thorough examination, from original sources, of the life and works of one of the greatest among the scientific humanists; and special attention has been paid to the bibliography of the subject. Besides a life of Münster (pp. 15–33), we have a detailed examination of his work as cosmographer and cartographer (pp. 33–69, 69–125); and herewith special sections are devoted (among the eight chief works of the author) to the *Germaniæ descriptio* of 1530, the *Novus Orbis* of 1532, the *Mappa Europæ* of 1536, the *Rhætia* of 1538, the editions of Solinus, Mela, and Ptolemy of 1538–1540, and the great *Cosmographia* of 1544. As a cartographer, Münster is here especially studied in his relation to German lands; but a full account is given of the title, scale, size, orientation, contents, sources, and mistakes of every one of Münster's maps, in relation to all the chief parts of the world. Lastly, the labours of this many-sided scholar, in the more purely mathematical and astronomical side of his subject (pp. 125–130), are dealt with, and even his Hebrew studies are not forgotten. Münster's geographical knowledge was based on what he learnt from Pellikan and Stöffler. From the former he acquired his first instalment of map-science, from the latter a thorough familiarity with the works of ancient geography, and in particular of Ptolemy. At Heidelberg he pursued his cosmographical studies with

* 'Sebastian Münster: Leben, Werk, wissenschaftliche Bedeutung.' Von Viktor Hantzsch. Leipzig: Teubner, 1898 (in the eighteenth vol. of the Publications of the Royal Society of Sciences of Saxony, Historico-philological section).

great zeal, and in 1528 brought out a brief *Erklerung des newen Instruments der Sunnen nach allen Seinen Scheyben und Circkeln.* With this went *Eyn vermanung an alle liebhaber der Künsteun, in hilff zu thun zu warer und rechter beschreybung Teütscher Nation.* In the latter, where the plan of much of his most important work is foreshadowed, he complains of old-standing inaccuracies, refers to the previous efforts of Conrad Peutinger to obtain a reliable topography of the Augsburg district, and supplies directions for the detailed observation and surveying of a given district. In spite of slender encouragement, Münster began to fulfil his promise of encyclopædic work (in August, 1530) with the little *Germaniæ descriptio*; and a year after the appearance of this book, towards the end of 1531, he began to take part in the *Novus Orbis* published by J. Herwagen of Basel in 1532. This contained many of the best ancient and modern travel-descriptions, and was accompanied by a mappe-monde designed by Münster, of elliptical shape, and illustrated by a short commentary. Here the roundness of the world and its division in zones and continents, including the new (but unnamed) regions of the west, is assumed; the 'uninhabitable' tropics are noticed as an exploded fallacy of the ancients. Brief summaries are given of the discoveries of Columbus, Vespucci, Varthema, and the Portuguese, and a curiously pessimistic description of Germany occurs. Münster's editions of Solinus and Pomponius Mela in 1538, and of Ptolemy in 1540, showed not only a good deal of philological study, but a keen insight into mathematical geography. The difficult passages of Ptolemy's first book on cartographical representation, and especially on the two most favoured projections of the Alexandrian geographer, are well explained with the aid of plates; but no reference is made by the editor in his additional remarks to the new discoveries, except in the case of Varthema's travels. The continents are defined in a strictly antique manner (as separated by the Nile, Tanais, etc.); and absurd etymologies, useless digressions, and occasional trivialities disfigure an otherwise excellent piece of work.

The *Cosmographia* (*Beschreibūg aller Lender*) of 1544, for which Münster had been preparing during the last eighteen years, was the first detailed, scientific, and at the same time popular, description of the world which had yet appeared in German. In it more than 120 persons —writers and scholars, artists and men of affairs—had taken part, and the result was a crowning effort of the geographical literature of the Reformation period. In the preface the end in view is defined as a 'description of the whole world with all that therein is;' but this includes a very complete treatment of mathematical geography, and of astronomy, history, and all other kindred or illustrative sciences or studies. Even the story of human culture is recounted from the Creation to the date of writing. Among the sections of this great treatise, the third book, on Germany, is the most important; the fourth and fifth, on

Northern and Eastern Europe, and on Asia and the new-found islands, are perhaps the least valuable; for here, *e.g.*, Greenland is treated as a peninsula running off from the country of the Lapps, and no attempt is made to bring Asiatic and American 'Earth-knowledge' up to date. The old stories from Pliny and Solinus are repeated; the contemporary colonial enterprises of the Fuggers of Augsburg in Chili and the Pacific, the flourishing trade of German merchants in Brazil, and the enterprises of German fortune-hunters in Venezuela, are not even glanced at in a treatise whose special object was the instruction of Germans. On the other hand, Western Europe is excellently treated, and the popular and even brilliant style of the writer attracted all the educated world; his impartial tone secured as warm a welcome among Catholics as among Protestants; forty editions appeared in Germany alone; and for more than a century the book was prized as one of the chief treasures of German literature and science. In many families it was handed down from father to son as a kind of secular bible, and its extremely rich assortment of quotations from, and references to, ancient sources, uncritical as these often were, gave no little satisfaction to sixteenth-century readers. Scarcely any prominent historical or geographical author of Münster's own period is unnoticed in the *Cosmographia*, and among the rest may be instanced Waldseemüller, Schöner, J. Honter, P. Appianus, Seb. Franck, Paulus Jovius, Damian de Goes, J. Ziegler, and Ægidius Tschudi. The city- and costume-pictures and the portraits, especially of the 1550 edition, are still valued by artists and antiquarians, and have been often reproduced; immense additions were made in the author's lifetime, especially as to Western Europe (England, France, Spain, and Italy); and the original six books gradually swelled to eight. But just as the final form of the *Beschreibung* shows a steady improvement in the consultation and intelligent use of all material available for the Latin and Teutonic world, so the neglect of literature relating to Asia, Africa, and America continues, like the old faults of uncritical scholarship and excessive attention to the anecdotical and adventurous elements in history and geography.

Lastly, in cartography Münster was not, as he has sometimes been called, the earliest German atlas-maker, but he was the first who popularized a field where his chief predecessors, Waldseemüller and J. Ruysch, M. Behaim and Schöner, had done such admirable pioneer work. In twenty-six years their untiring and versatile successor published one hundred and forty-two maps, of which the value was by no means uniform, but which together formed a material addition to earlier studies. In the present monograph no pains have been spared, and the result is eminently satisfactory; if anything further could have been desired, it would have been, perhaps, the reproduction of some typical sections of Münster's *tabulæ* and *chartæ*.

THE MONTHLY RECORD.

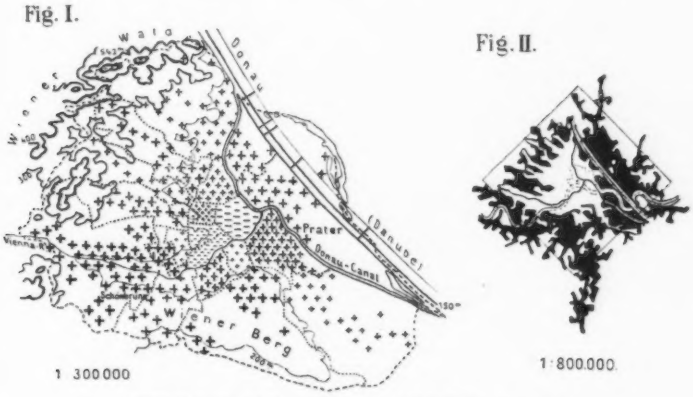
EUROPE.

The Former Extent of Forest in Scotland.—In a paper reprinted from the *Annals of the Andersonian Naturalists' Society* (Glasgow, 1900), Mr. Hugh Boyd Watt discusses the question of the extent of Scottish forests and woodlands in early historic times, as indicated in the works of Roman historians and early English writers, as well by topographical or traditional evidence. The author quotes passages from the 'Agricola' of Tacitus, in which reference is made to woods traversed or cut down by the invaders, but considers that these probably do not cover much ground, and that it is inaccurate to say that the whole country was covered at this period with dense trees. The term "Caledonian forest," or an equivalent expression employed by such writers as Ptolemy and Pliny, seems, he thinks, to apply to a definite locality regarded by the Romans as pre-eminently woodland, which reached south to the heads of Loch Long and Loch Lomond, east to Stirling, and north to Dunkeld. With the extension of the name Caledonia —in which is probably contained the Gaelic root *coille*, "a wood"—to the whole of Scotland, the Caledonian forest has likewise broken its bounds and rolled over the whole country. In still earlier times, it is probable, as shown by the evidence of the present peat mosses and bogs, that one vast forest, of which the "Sylva Caledonia" was but a scanty remnant, covered the greater part of the country. In many widely separated localities huge trunks have been found buried in the mosses, where now no natural wood of any size can grow; but the age of the forests which they represent cannot be laid down with certainty. In some cases they seem to date back beyond all written history, while in others the change from forest to peat-moss has taken place in quite recent times, being often due to violent hurricanes. The former abundance of wood is likewise shown by the fact that for ages timber was the staple material for house-building, and the only material for boat-building; by the frequent traces of "bloomeries," or iron-smelting furnaces, for which the only fuel, down to 1760, was wood or charcoal; and by the frequent reference to trees in Scottish place-names.

The Woods of the Thuringer Wald.—An interesting study, by Luise Gerbing, of the changes which have taken place within historic times in the composition of the woods of the Thuringer Wald appears in the *Mitteilungen des Vereins für Erdkunde zu Halle* for 1900. The writer divides the region in question into three zones—the first, extending from the confluence of the Werra and Hörsel to the Laucha, being that of deciduous forests; the second, reaching south-west to the Apfelstadt, consisting of mixed woods, in which, however, deciduous kinds predominate; while the third, and largest, in which conifers predominate, reaches almost to the town of Ilmenau. For each of these the writer examines the former state of the forests as indicated on the one hand by old records, and the evidence supplied by the names of the mountains and forests; and on the other, by the discoveries which have been made of the trunks of trees buried beneath existing peat-bogs. As regards the distribution of individual kinds of trees, the following facts are elicited. The oak is shown, by its frequent occurrence in place-names and buried beneath the surface of bogs, to have, in very early times, not only occupied the valleys and lower slopes, but to have ascended to the summit ridge of the Rennsteig. In post-mediæval times its chief habitat was on the southern margin of the range, where extensive forests entirely composed of oaks occurred. The beech originally formed the principal constituent of the mountain forests proper, but already in the sixteenth century its range had been much curtailed. It is uncertain whether the sycamore ever formed, by itself, entire woods, though the

evidence of nomenclature seems to point in this direction. The ash was once as widely distributed as it was highly prized, forming woods, not only on the lower slopes, but even on the summits. The sallow, once an occupant of mountain swamps, has almost disappeared with the draining of these, while the lime and elm were once more common than at present. The hazel was likewise much more widely distributed in the form of underwood. Of conifers, which in the "Schwarzwald" or eastern part of the district must always have occupied an important place, the spruce (*Picea vulgaris*) seems to have formed the exception, the silver fir (*abies pectinata*) the rule. No place-names supply evidence of the presence of the former in pre-historic times, and only two or three of the latter. Within the last century, however, the silver fir has yielded more and more to the spruce. The Scotch pine (*Pinus silvestris*) has been stated to be non-endemic in this region, but the name Kienberg may possibly point to the reverse conclusion. The yew, which still lingers in a few localities, owes its diminished range in part to its use for making bows. The most salient fact brought out by the study is that of the rapid extension of coniferous, at the expense of deciduous, forests—an extension which promises to continue in the future, though at present it has hardly effected a radical transformation in the conditions in the Thuringer Wald.

The Growth of Vienna.—The preliminary results of the census of Vienna, taken on December 31, 1900, show that, including the military, the city has a population of 1,662,300—an increase of 279,700, or 21·8 per cent. since 1890. The number of houses has, on the other hand, increased by only 3800, or about 13 per cent., the difference being due to the increased size of the new buildings as compared with the older houses. The distribution of the increase, or more correctly the



SKETCH-MAPS ILLUSTRATING THE GROWTH OF VIENNA.

displacement of density within the city, is just that which is characteristic of important centres of industry and trade. Fig. I. shows that of the twenty districts comprised within the city, that known as the "Innere Stadt," occupying a position analogous to that of the "city" in the case of London, and the thickly populated portions grouped around the "centre of gravity" of the whole, show a decrease in population (denoted in the map by the minus sign) which reaches more than 14 per cent. in the case of the "Innere Stadt." The other enclosed districts have either increased very slightly, or at least at a rate *below* the average of 21·8 per cent. A

rate *above* this average is shown only by the outer districts—except those in the extreme north and south-east—and of these especially by those in the south and south-west. Here, where the fringe of the inhabited ground on the one hand ascends the gentle rise of the Wiener Berg (defined in Fig. I. by the contour-line of 200 metres), and on the other spreads farther and farther over the broad valley of the Wiener Fluss and the slopes of the Wiener Wald, which even within the city limits reach the considerable altitude of 1780 feet; the population has in one decade increased by 46 to 51 per cent., or roughly by one-half. A comparative view of the size of the inhabited area in the case of London and Vienna is given in Fig. II., which shows the extent of settlement (shown for Vienna by the interior blank space) within a square of 100 statute miles, with the foci whence the growth has taken place. It clearly brings out the contrast exhibited between the action of the two great streams on the direction of growth of the cities, the broad outlines of the form being determined in the case of London by the meeting at right angles of two main lines of communication, the one taking its direction from the Thames, the other from the meridional extension of the island of Great Britain; while in the case of Vienna the outline is due to the form of the surface.

Resumption of the Survey of Greece.—The survey of Greece, which has been interrupted for some years as a result of the unhappy war with Turkey, is to be resumed during the present spring under the superintendence of Henrich Hartl, formerly colonel on the staff of the Military Geographical Institute at Vienna, and now professor at the Vienna University. Prof. Hartl was summoned to Athens last autumn to inspect the topographical bureau formerly established by him, and expressed his thorough satisfaction with the excellent arrangement of the material so far brought together, the only desideratum being a somewhat more complete training for the survey officers. The official order provides for the resumption of the cadastral survey by communes; but it is more than probable that the execution of this will again, as under Tricoupis, be frustrated through the opposition of the popular representatives to the introduction of a bill for the demarcation of boundaries. Prof. Hartl therefore hopes that the survey may at least be quickly brought to a conclusion on the uniform system requisite for a map of the whole kingdom which shall fulfil the requirements which may justly be made on it.

AFRICA.

The Position of El Obeid.—Writing from Goz Abu Guma, on the White Nile, south of Khartum, on February 23, Colonel the Hon. G. Talbot informs us that he had then just returned from a visit to El Obeid, the position of which he had fixed by means of the telegraph as in 13° 10′ 34″ N., 30° 13′ 39″ E., or considerably farther west than it has been hitherto placed on our maps. Very little of the old town is left, only a gateway of the old Mudirieh buildings. Colonel Talbot has also fixed a large number of positions by latitudes and chronometric longitudes, besides having some detailed topographical work done, so that he hopes to bring out some more provisional sheets of the survey during the summer.

Place-names in the Uganda Protectorate.—We have been favoured by the Foreign Office with a copy of a despatch from Sir Harry Johnston, laying down the correct spelling of various native names in the Uganda Protectorate, in addition to those already referred to in the last number of the *Journal*. Sir Harry Johnston urges that where native names are retained they should be so spelt and pronounced as to be recognizable by the natives, which at present is far from being the case, owing, in great measure, to the fact that the first explorers obtained the names mainly through Swahili porters and interpreters. He has taken much pains, by consultation with the missionaries and native authorities, to obtain the correct

rendering, which is given in the right-hand columns in the table below. A few words, such as Wadelai, Masindi, Ruwenzori, Unyoro, and Uganda, which have been established by long usage, have been left undisturbed, and this might, perhaps, have been the case with Mruli, which has maintained its station on our maps ever since Baker's time.

Incorrect form.	Correct form.	Incorrect form.	Correct form.
Njemps	Enjamesi	Fort Berry	Fort Portal
Eldoma	Eldama	Lake Choga	Lake Kioga
Usoga	Busoga	Szo, Scio river	Sio
Ugaya island	Bugaya	Kitakwenda	Kitagwenda
Uvuma island	Buvuma	Wakedi	Bukedi
Chagwe	Kiagwe	Mruli	Buruli
Bulamwezi	Bulemezi	Urega	Burega
Ntebe	Entebbe	Balegga	Barega
Ke- or Kasubi	Kisubi	Bugahia	Bugaya
Sesse	Sese	Chamburango	Kiambalango
Na- or Matiana	Mitiana	Ruisamba lake	Dueru
Uddu	Buddu	Ibanda (Ankole)	Iwanda

In Uganda proper, Sir H. Johnston says, any native place-name spelt with "ch" or "h" is wrong. For the former, "ki" must be substituted, and the latter must be omitted. The name Ruisamba is said to be merely that of a village on the lake, of which the proper name is Dueru. The names of Forts Edward, Lorne, Briggs, De Winton, Roddy, Lugard, and Wavertree should be erased, as they were applied to temporary stockades only. Fort George on the Albert Edward lake is, however, a permanent station.

German Boundary Expedition to the Kivu Region.—The arrival at Ujiji of the German expedition for the settlement of the boundary question with the Congo State in the region of Lake Kivu, is announced in the *Deutsches Colonialblatt* for March 15, in a letter from the leader, Captain Herrmann. During the journey from the coast a halt had been made at Tabora, in order to allow of the determination of the longitude of that important position by an observation of the solar eclipse of November 22. This was carried out successfully by Prof. Lamp, and the result should be to determine the longitude of Tabora with great exactness. During the march to Ujiji rain fell daily, the wet season having set in early, and promising to be marked by an unusually heavy fall. On December 10 the two Belgian commissioners arrived on board the German steamer *Hedwig von Wissmann* (see below), which made a great impression on Captain Herrmann. The *Good News* is now used as a sailing vessel, owing to an accident to her machinery. Captain Herrmann proposed to establish a station for the rainy reason at Usumbura, where his Belgian colleagues would join him when ready to commence operations.

Boundary Survey on the Nyasa-Tanganyika Plateau.—The surveys of the German section of the commission by which this boundary was demarcated in 1898, have now been published in the fourth number of the *Mitteilungen aus den Deutschen Schutzgebieten* for 1900. The detailed nature of the surveys may be judged from the fact that the large scale of 1 : 100,000 has been employed for the 4-sheet map, which is still fairly well filled in the parts coinciding with the districts surveyed. These were not limited to the actual line of the boundary, but extended over a considerable area on the German side. The basis of the work was supplied by the astronomical observations and triangulation, fully described by Dr. Kohlschütter in the accompanying text, but the detail of the surface features is due to the careful plane-table work and compass surveys of Captain Herrmann, whose original map has been reproduced without alteration except where a trifling shifting of the triangulation points has been necessary to harmonize them with

Dr. Kohlschütter's results. The boundary as laid down by the commissioners differs considerably from that fixed in 1890, especially in the western section. Instead of taking a straight course from the Kalambo to the 32nd meridian, it follows first the Safu tributary of the Kalambo, next the Mkumba and Rumi rivers to the confluence of the latter with the Saisi, and, after descending this river for some distance, crosses over to another tributary, which it ascends to the Congo watershed. As already stated by Captain Boileau in his paper read before the Society early in 1899, this water-parting, which for nearly a degree of longitude forms the boundary, has been shifted considerably to the south, so that German East Africa gains some territory at the expense of British Central Africa. In one section a portion of the Stevenson road, as originally traced, falls within the former. In one or two cases the commissioners have recommended a deviation from the water-parting, the change being to the advantage of Germany near the British station of Ikomba, which is now almost on the frontier, but to that of Great Britain near Ikaua. The most striking feature in the physical geography, as brought out by the map, is the great regularity of the escarpment of the plateau, known throughout its length as Chingambo, which has been sometimes spoken of as a mountain range. It has been carefully mapped for some distance, the routes of the German surveyors traversing it in no fewer than eleven places. It is continued with hardly a break in its uniformity north-west across the valley of the upper Saisi, while at its foot extends the plain which merges eventually with that of Lake Rukwa. Its slopes are stony and thinly wooded, but rubber is found in ravines. Captain Herrmann gives a brief description of the country and people along the frontier, and like other travellers, speaks very highly of the capabilities of the Buntali country north of the Songwe valley, which is said to be an ideal country for coffee. The best route between the two great lakes within German territory is said to lie in part along the Songwe and its tributary the Kiya, in part along the plains at the foot of the great escarpment, finally reaching Tanganyika at Kala (8° 10′ S.), though the line to be taken across the Fipa plateau is not mentioned.

German Steamer on Lake Tanganyika.—An account appears in the *Deutsche Kolonialzeitung* of January 24 of the launch on Lake Tanganyika of the *Hedwig von Wissmann*, the steamer which, as already mentioned in the *Journal*, was taken out in sections by the expedition *viâ* Lake Nyasa, commanded by Lieut. Schloifer. That officer's letters give a vivid picture of the difficulties encountered during the launching operations after the vessel was ready to leave the stocks. Kassanga, though the most suitable place which could be chosen on the part of the lake which was the scene of operations, had the disadvantage of a gently sloping beach, and it was only after fourteen days' hard work that the vessel was at last dragged into deep water. The christening ceremony having been performed by the wife of Lieut. Schloifer, more than seven hundred men were employed hauling on the ropes and chain-cables, which proved unable to stand the strain. Others were eventually borrowed from the British Flotilla Company, which is building a steamer at Nasakalawe, on the other side of the lake; and on October 4, 1900, the launch was successfully accomplished, though each day's work only sufficed to move the vessel a few yards. Mr. Codrington, Administrator of Northern Rhodesia, was present at the time. The vessel has since made her first trip northward, after taking on board eight passengers, mostly Belgian officers, at Kituta. The German station near the south-east end of the lake has been named Bismarkburg.

Steamer on Lake Mweru.—The small steamer (the *Scotia*) recently launched on Lake Mweru by the African Lakes Corporation, made a trip in October last from Chienyi, at the north of the lake, to the foot of the Mambilima,

or Johnston falls, on the Luapula, and back. Some difficulty was experienced in obtaining a supply of wood, the natives bringing it in small bundles of a few sticks only, and requiring payment for each bundle separately. The outward voyage was made along the east shore, where, down to the Kalungwizi, the land rises abruptly to a height of 100 to 150 feet, the water being generally deep close to the shore. In the Luapula, too, there is ample water for navigation, "no bottom" being the rule even at the height of the dry season. At the falls, to the foot of which the *Scotia*, drawing 2 feet 9 inches to 3 feet aft, was able to steam, a station was being built for the British South Africa Company by Mr. Lyons. On the return voyage, a visit was paid to Kilwa island, which, though rising abruptly on the east, is low and flat, with grass and trees growing well out into the lake, on the south and west. The whole south-western bay of the lake is fringed with grass and mangrove swamp, and has a most uninviting aspect. From Kilwa the voyage was continued along the high western shore. The above details are from the log of the *Scotia*, extracts from which appear in the *Glasgow Herald* of March 7.

Exploration of the Ngoko.—The western branch of the Sanga, the Ngoko or Ja, has lately been explored beyond the point reached by Dr. Pleyn (*Journal*, vol. xiv. p. 444), by a Belgian engineer named Williams and the German Lieut. von Stein, whose work in the Cameroons territory nearer the coast has frequently been referred to in the *Journal*. Some details are given in the *Mouvement Géographique* of January 27 last (No. 4, 1901), which also announces the early return to this region of the well-known explorer Von Carnap. The examination of the course of the Ngoko below the rapids discovered by Dr. Pleyn (for which the name Pleyn rapids is suggested by M. Wauters) has shown that in August, when the river is at its lowest, navigation is possible by the small steamers of the South Cameroons Company from its mouth, where it has a breadth of 200 yards, to a place called Mulundu. Beyond this the pass of Shama is impracticable at low water, though at high water (November) the depth is as much as 10 feet, increasing to 25 feet above the pass. At the Pleyn rapids the river dashes into a narrow gorge (40 to 50 yards), the sides of which rise 800 to 1200 feet above the water. Higher up the current is still very rapid, though the width increases to 160 yards, with depths reaching 25 feet. For a space the country is flat and swampy, but after some 30 miles the river flows between high mountains. This district is quite uninhabited, but elephants, hippopotami, crocodiles, and gorillas are met with. Rubber vines and trees were seen on the river-banks, together with wild coffee and vanilla.

AMERICA.

New Director of the Geological Survey of Canada.—The successor, as Director of the Geological Survey of Canada, to Dr. George M. Dawson, whose lamented death is referred to below (p. 438), is Dr. Robert Bell, senior member of the staff of the survey which he joined so far back as 1857. During his active career in connection with the survey, Dr. Bell has executed surveys, both geological and topographical, in almost every part of Canada, and has published a large number of reports and papers. One read before our Society in 1897, on Explorations south of Hudson Bay, appeared in the tenth volume of the *Journal*.

Geological Exploration in Alaska.—We learn from *Science* that an arctic party of the United States Geological Survey will this year proceed from Bergman, on the Koyukuk river, to the divide, and then descend some stream to the arctic coast, following this southward and westward. A second party will descend the Kowak river to Kotzebue sound, and a third will continue the investigation of the Copper river region.

The Tectonic Lines of Central America.—The paper in which Dr. Carl Sapper last year described before the Berlin Geographical Society the main results of his twelve years' researches on the physical geography of Central America has been printed in the eighth number of the *Verhandlungen* for 1900. Dr. Sapper began by pointing out the characteristic manner in which most of the Central American ranges, especially in the northern half of the country, run in regular curves, generally concave to the north, as is well shown by the diagrammatic map which accompanies the paper. In the south the only well-developed arc is that of the central chain of Costa Rica, and it is not yet certain whether this is of the same age as the older part of the northern chains. In these, archæan rocks play a conspicuous part, certain whole chains being formed of gneiss, mica-schist, and phyllite. These primitive ranges, which have their continuation in South-West Mexico on the one side and in the Greater Antilles on the other, were dry land during the first half of the Palæozoic epoch, but were, in part at least, covered by sea during the Carboniferous period, the end of which was marked by a new period of folding, during which the greater part of the old eruptive rocks seem to have been poured forth. After this, most of the country was above water till towards the close of the Mesozoic epoch, only to be submerged again, with the exception of the Palæozoic chains, during the Cretaceous and Early Tertiary. The Mesozoic folded ranges are best developed in the west, in Chiapas and Central Guatemala; between which two districts they are broken through by the depression of the Peten. In Honduras and Nicaragua they play a part of diminishing importance. In the former, the Esquias range shows a north-to-south strike, which seems to point to the conclusion that the remarkable depression which crosses Central America between Puerto Cortez and Fonseca bay may be due as much to tectonic causes as to denudation. In Nicaragua an unusually important part is played by new volcanic outpourings, which seem to have taken place towards the end of the Miocene period. This was a time of renewed great dislocations, which have been the chief agents in determining the present surface features of Central America, though there have of course been more recent oscillations, such as have added to the area of the Yucatan peninsula, and given rise to the present coast conditions of British Honduras. The majestic volcanoes of Central America were likewise formed as late as, if not later than, the Pliocene period. The later part of Dr. Sapper's paper deals with the climate and vegetation of Central America, as influenced by the surface features. In the absence of extensive plains, a great variety of climatic conditions is brought about by the variations of relief. The popular division of the country into the three zones of the *tierra caliente*, *templada*, and *fria*, is based on altitude, but the rainfall of different districts depends largely, at least during the prevalence of the trade winds, upon the direction of the ranges, and the great variation in its amount and distribution through the year has an important effect on the vegetation. Where the fall exceeds 80 inches and is distributed over the whole year, rich tropical forests are found. Where, however, it varies between 40 and 80 inches, and there is a well-marked dry season, these give place to light forests of pine and oaks; and if the fall is less than 40 inches, the prevailing form is that of savannas or bush steppes. Tropical forests occupy a large area between the plateau of South Yucatan and the chain of Central Guatemala; the seaward face of certain ranges in Chiapas and Honduras; and the eastern slope of the central plateau of Nicaragua. Historical factors have been of importance in the distribution of the flora as well as in that of the fauna and native population. In all three the influence both of North and South America is clearly discernible.

Census of Porto Rico.—The U.S. War Department has lately published the leading results of the census of Porto Rico taken under its direction in the autumn

of 1899, a summary of which by Mr. Henry Gannett appears in the *Bulletin* of the American Geographical Society, No. 4, 1900. The plan and administration were similar to those of the United States census, the island being divided into seven supervisors' districts, corresponding to the seven governmental departments, and each of these into numerous enumeration districts, with an average population of about 1000. The total number of inhabitants of Porto Rico was 953,243, as compared with 798,565 in 1887, the date of the latest official Spanish census, indicating a decennial rate of increase of 16·2 per cent., a rate about the same as that of Ohio during the decade between 1880 and 1890. The population by department in 1899 was as follows: Guayama, 111,986; Humacao, 88,501; Ponce, 203,191; Arecibo, 162,308; Bayamon, 160,046; Mayaquez, 127,566; Aguadilla, 99,645. Porto Rico, with an area of 3600 square miles, is, on the average, very densely settled, there being about as many inhabitants to a square mile as in the State of Massachusetts, but it is shown that, while in the latter State the greater part of the population is collected in cities, in Porto Rico the urban element is small, and the population is distributed uniformly over the island. While the ratio of children was higher in this island than in any State in the Union or in any country of Western Europe, marked differences appear at advanced ages. Persons over forty-five years of age in Porto Rico constituted only 11·8 per cent. of the population, while in the United States they constituted 17·2 per cent., a fact that suggests for the island a large death-rate and short life-period. Distributed by race, Porto Rico contained 59,390 negroes, 304,352 persons of mixed white and negro blood, and 75 Chinese, making a total coloured population of 363,817, or 38·2 per cent. of the population—a proportion about the same as in the State of Virginia, and somewhat higher than that of Cuba. The proportion of coloured was greater in the eastern part of the island than elsewhere. It appears, from comparison with figures of earlier censuses, that the coloured element, although increasing numerically, has decreased in proportion to the whites, as is the case in the United States and in Cuba.

Proposed Scientific Exploration in Surinam.—The last number of the *Tijdschrift* of the Netherlands Geographical Society (1901, No. 2) announces that an important expedition is being organized in Holland for the exploration of the little-known interior of Dutch Guiana. The project is supported by two Dutch colonial societies, as well as by the Royal Netherlands Geographical Society, each of the three bodies being represented on a committee, which has been formed for the carrying out of the necessary arrangements. The expedition will be commanded by L. A. Bakhuis, late of the Topographical Service of the Netherlands Indies, who acted as topographer to the Sumatra expedition of J. W. Ijzerman in 1890. It is expected that W. L. Loth, well known as a traveller and surveyor in Surinam, will also take part in the expedition, which may also include a botanist. The sphere of action will probably be the basin of the Kopename, the principal river of Central Surinam, which is at present very little known. A start will be made from the Raleigh falls, and the course of the river will be followed southward to the mountainous region in which it rises.

POLAR REGIONS.

The Degree-measurement in Spitsbergen.—Recent numbers of *Ymer* (Nos. 2 and 3, 1900) contain some accounts of the Russo-Swedish operations for the measurement of an arc of the meridian in Spitsbergen, though full details have not yet been published. The first paper, by V. Carlheim-Gyllensköld, gives a general account of the work, especially that performed by the Swedish party which had its headquarters at Treurenberg bay. This began with the careful measurement of a

base-line (August 12 to 23, 1899). The subsequent observation of angles was much impeded by the weather, and little had been done in this direction before the sailing of the *Svenskund* on September 14. Some topographical work had, however, been accomplished, both in the neighbourhood of Murchison bay and Mount Celsius (where determination of latitude and azimuth were made), and in that of Lady Franklin bay and Capes Hansteen and Hekla. Geographically, the most interesting work was the attempt made by Rubin and Fraenkel to reach Mount Chydenius from East fiord, the eastern arm of Wijde bay. The route lay south-east, up a great glacier which flowed between steep inaccessible cliffs, while the surface was at times so broken as to render it exceedingly difficult to make any way with the sledges. Constant fog also prevailed, making it impossible for the most part to obtain any distant views which might have thrown light on the geography of the country. On the third day, after reaching an altitude of some 2650 feet, the travellers left their sledge and tent and ascended a pass to the south (8860 feet), from the summit of which a break in the mist allowed a glimpse of the surrounding country. To the east lay a seemingly impassable range, forming the western limit of the inland ice, and apparently including the summit named Chydenius, when seen from the opposite direction. A pyramidal peak was seen to the south-west, and another high summit to the south-east; but, the weather being still unpropitious, it was decided to return. The furthest point reached was placed by dead reckoning in 79° 6′·5 N., 16° 58′·9 E. The second paper, a translation of which has been kindly placed at our disposal by the Hydrographer to the Admiralty, is by Gerard de Geer, the Swedish representative with the Russian party under T. H. Chernicheff, and outlines the work done in southern Spitsbergen in the summer of 1899. The first part of the paper describes the selection of the winter station at Goës harbour, near the south side of Horn sound, and the unavailing attempts to push northward to the Swedish station. The failure of these is ascribed in great measure to the reluctance of the ice-pilots to take the ship into the belts of drift-ice, which they erroneously took for heavy pack, the coasts of Spitsbergen being, as a matter of fact, particularly free from ice during that season. Meanwhile, the surveyors were busy with the erection of signals at various points around the Stor fiord, their operations being, however, much hampered by the fogs and cloud-caps on the mountains. It rarely happened that all the signals were visible at the same time, for the winds which cleared the clouds from the summits on one side of the fiord would blow as a sea-wind on the other, and so induce the formation of clouds. The thickest fogs and heaviest rain occurred near the mouth of the Stor fiord, while the country inland from Ice fiord and Bell sound showed by its richer vegetation and less developed glaciers that it enjoyed a greater amount of sunshine. The reconnaissances made during the early summer showed the advisability of a modification of the original plan for the connection of the northern and southern surveys. In place of the snow-clad Hvitaberg (White mountain) it was found more suitable to choose either Mount Hellwald or Mount Steinhauser, while the difficulties of access to Mount Chydenius—not one, but a whole series of mountain summits—rendered it doubtful whether or not a signal could be erected on it. The discovery that the Svansberg, placed on the older charts near the coast, is in reality 9 miles further inland, and the only dominating summit in this part of the island, led to its choice as a connecting station, and Herr de Geer gives an interesting account of an expedition led by him to its summit for the purpose of fixing up a signal. The starting-point was the extremity of the vast glacier which forms the termination of the Stor fiord on the north-west, and the route lay at first over very rough ice. The altitude of the ice-sheet near the southern end of the Svansberg, from which the ascent was begun, was about 1880 feet, and the southern extremity

of the summit plateau, in part covered by an ice-cap, about 3200 feet. The temperature here varied from 24° to 28° Fahr. A beacon was built up of stone found on the summit, and, as was learnt afterwards, observed almost immediately by the Russians stationed on Cape Lee. The mountain proved to lie nearer Ice fiord (Klas Billen bay) than Stor fiord, so that in future its ascent could be more easily effected from the west. The writer makes a detailed statement of the scientific results of the operations of 1899, which included, in addition to the careful mapping of large areas, important geological observations, permitting for the first time the construction of a geological section across the island, showing the limits of the Trias, Carboniferous, and Silurian formations.

A New Plan for reaching the North Pole.—The latest project for the attainment of the north pole is one brought forward by Herr Anschütz-Kämpfe, of Munich, who has adopted and made his own an idea first mooted some years ago in Sweden, that the pole may be reached by means of a submarine boat passing *under* the ice of the arctic ocean. The projector, for whom such a vessel is now being built by German engineers at Wilhelmshaven, lately described his plans at a meeting of the Vienna Geographical Society. The main factors affecting the practicability of the scheme are—firstly, the extent of the separate ice-fields in the polar sea; and, secondly, the depth below the surface to which the ice reaches. From extensive study, as well as personal observation, the lecturer had arrived at the conclusion that the average maximum depth of the pack-ice may be taken to be 80 feet, while the mean thickness does not exceed 16 to 20 feet. Land-ice, reaching, in the form of icebergs, a depth below water of several hundred feet, may, he thinks, from its virtual absence from the seas in question, be left out of consideration, while our present knowledge of the depths attained by the polar basin justifies the opinion that reefs of rock rising towards the surface of the ocean are not to be expected. The proposed vessel will be capable of descending to a depth of 160 feet, at which it will be entirely removed from the influence of cold, storms, and ice-pressure, and the way to the pole will be therefore open. The length of time during which it will be able to remain below the surface is calculated at a maximum of fifteen hours, which, at the modest rate of 3 knots, allows it to cover a distance of some 50 miles, whereas the combined experience of polar voyagers shows that continuous fields of pack-ice never exceed a maximum diameter of about 3 English miles. In the improbable case of no opening being met with within the fifteen hours, there remains the possibility of opening a way by blasting at a weak point in the ice, to be indicated without possibility of mistake by the help of the manometer. The risk of injury by collision will be minimized, not only by the slow rate of motion, but by the great power of resistance to be possessed by the ship, and indispensable on account of the great pressure to which it will be subject from the water. Its form will be that of an ellipsoid of rotation, with a major axis of 70 feet and a breadth of 26 feet, giving a displacement of 800 tons. To obviate rolling, the centre of gravity will be placed as low as possible. The capacity of the interior will be 3500 cubic feet, which allows sufficient air for five men for fifteen hours, the carbonic acid evolved being removed by combination with caustic soda. Propulsion will be effected by horizontal and vertical screws, the former of 40, the latter of 5, horse-power, this last being sufficient to counteract the tendency to rise; while the motive power is to be supplied by a petroleum motor through the medium of a 220 volt accumulator. One hundred and fifty tons of petroleum will be taken, or more than ten times the quantity needed for the 600-mile voyage to the pole from Spitzbergen, to which, or rather to the edge of the ice, the submarine boat will be towed. On arrival at the pack, the direction of the first open water will be taken by the compass, and, the

boat being submerged, a course will be steered for it. If, after an hour or so, the light shows that an opening has been reached, the vertical screw will be stopped, and the boat will rise by its own buoyancy, and, in case of a wide opening, or channel leading northwards, the voyage will be continued on the surface, giving an opportunity for scientific work. Supposing no gleam of light appears when six hours have elapsed, an ascent to the lower surface of the ice will be made with caution, and the voyage continued slowly until, by the reading of the manometer, it is found that a thin place has been reached. Here attempts will be made by blasting to effect an opening, which, however small, will be sufficient to supply air for another fifteen hour ; while, in case of failure, there will still be time to return to the last opening that has been left, whence the voyage will be prosecuted in a slightly different direction. But both the assumptions made—that of an uninterrupted ice-field more than 18 nautical miles in diameter, and of one so continuously thick as to defy all efforts at disruption, are entirely contradicted by all previous experience.

Ice in the Arctic Seas, 1900.—The Danish Meteorological Institute has recently issued its report on the state of the ice in the arctic seas during 1900, prepared by Mr. V. Garde. As in former years, the institute has derived its information from captains of ships and others, being greatly assisted in the matter by the co-operation of other meteorological bodies. The results for 1900 are given for (1) the seas round Spitsbergen and Novaya Zemlya; (2) Greenland sea and Denmark strait; (3) Davis strait and Baffin bay; (4) Hudson strait and Labrador; and (5) Bering Sea. The general results may be summarized as follows: Great masses of ice were present in the north-western part of Barents sea and round Spitsbergen, as also in the Kara sea; less ice than usual between Franz Josef Land and Novaya Zemlya and under the east coast of Greenland; normal conditions under south-west Greenland, and particularly favourable conditions under Labrador and in Baffin bay. Heavy masses of ice apparently existed in the neighbourhood of Smith sound. The season 1900 is pointed out as greatly resembling that of 1899; Spitsbergen, however, was more blocked by ice than in that year. A series of maps, showing the distribution of ice in the seas east and west of Greenland during the months of March, April, May, June, July, and August, 1900, illustrates the report.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Classification of Climates.—Dr. Köppen has recently published a most important paper on the geography of climate. He starts with De Candolle's divisions of the world into seven thermal realms, one A megathermic, two C mesothermic, two D microthermic, two E hekistothermic, with two B xerophilic in the western and warmer parts of the globe where there are long droughts and great ranges of temperature. The boundaries between A and the two C's are the isotherms of 18° C. for the coldest month, between the C's and D's 22° C. for the warmest month, and between the D's and E's 10° C. for the warmest month; while the xerophilic regions are those where the relative humidity is under 36 per cent., and the quotient of the monthly rainfall in millimetres by the pressure of saturated vapour at the mean monthly temperature also in millimetres is 3, which practically means a rainfall probability of 0·36. Each of these realms is further subdivided. A.—The Megathermic realm may be subdivided by the isohyet of 30 millimetres in the driest month into A1, the equatorial region of lianas, Mr. Scott-Elliot's "wet jungles," with no rainy season or with a yearly precipitation of over 2000 millimetres. This reaches to the tropics only on the east coast, and is separated from them in the centre and west of the continents by A2, the baobab regions, or tropical savanas, with at least two dry months and less than 2000 millimetres of rain. B.—In the Xerophilic realm the rainfall

cannot be used alone to determine subdivisions, and the number of rainy days is more important. The subdivisions, as well as the exterior boundary of the realm, are determined by relative humidity and the quotients just mentioned. The west coastal strips are exceptions as regards humidity, for they are characterized by heavy dews, and vegetation of the *Welwitschia* type, and Dr. Köppen calls them B1, the garúa regions. At about lat. 40° the isotherm for the coldest month divides the Xerophilic realm into two. In the regions of milder winters, B3, that next the savanas, has heavy if rare thunder-storms in summer. It is a region of shrubs, and may be called the espinal or mezquite region. Farther from the equator is B2, the desert region, with great temperature changes and extremely rare showers. The date palm and the simum are characteristic. They are also found in B4, the tragacanth region, with a sub-tropical climate, rainless summer and cool winter with occasional rains. The regions with colder winters may be divided into B6, that of the buran, with the saxaul as characteristic plant, where the coldest month is under the freezing-point, and violent snowstorms occur in winter. It is surrounded by B7, the true prairie or steppe climate, which has equally severe winters, but has summer rain. B5, east Patagonia, is an exceptional climatic region, forming a link between the sub-tropical steppes and the tundra of higher latitudes. C.—The Mesothermic or true temperate climatic realm. Three sub-realms are to be distinguished. i. The eastern sub-tropical climate, with hot and rainy summers, and winters varying from cool to cold subdivided into C1, the camelia region with mild winters, whose coldest month is not lower than 2° C.; C2, the hickory region, where the winters are cold and long; and C3, the maize region, with a short if somewhat cold winter and a distinct dry period in late summer, a region intermediate to B7 and C4. ii. The classical sub-tropical region, with mild and moist winters and dry summers, the winter temperature being over 2° C. This is divided into two regions—C4, that of the olive, with a very hot and dry summer; and C5, that of the erica, where the summer is considerably cooler. iii. Beyond the region with the warmest month at 22° C. is a sub-realm which must be included in the Mesothermic realm, with the coldest month not lower than 6° C., the range of temperature small, and no dry period in summer. It is divided into C6, the fuchsia region, with rain at most seasons, or with a short dry period, but having a large total annual rainfall, at least 30 millimetres being precipitated in the driest month; and C7, the upland savana region, with a marked dry season in winter and spring, and with heavy thunderstorms in summer, often with rain and snow. Here the flowers bloom in the late summer. This is the region of the puna. It is distinguished from A2 by its greater coolness at all periods of the year, and from B3 by its lower summer temperature and greater rainfall. D.—The Microthermic or cool temperate realm is divided by the line where four months at least have a temperature of 10° C., into D1, the oak climate, and D2, the birch climate. D3 is the climate of the antarctic beech, with a range of less than 10° C., a maximum monthly temperature of 16° C., and a minimum of at least 0° C., while rain falls at all seasons. E.—The Hekistothermic realm may be divided into four different regions. E1 is that of the arctic tundra or arctic fox, with great extremes of temperature, and cold and relatively dry winters. E2, the antarctic or penguin region, has a small range of temperature and much rain at all periods. E3, the Pamir or Yak region, has a continental climate of great temperature ranges and radiation and slight rainfall. E4, the Alpine region, has small ranges of temperature and much rain. F is the realm of constant frost, where the mean temperature of the warmest month is under the freezing-point, and no vegetation grows. The vegetation period is constant in A1; it occurs during the rainy season in A2; it is changeable in B2; it falls in winter in B1; it happens in spring in B4, B6, B7, C3, C4, and C5; and in all the other regions it comes in summer.

British Pilot Chart of the North Atlantic.—We have received a copy of the specimen issue for January, 1901, of the Pilot Chart of the North Atlantic and the Mediterranean, which is to be published monthly by the Meteorological Council from April next. The main chart has the same boundaries as the United States pilot chart, but is on a somewhat smaller scale, and an inset map contains information for the eastern Mediterranean. The following are the principal data laid down, information relating to atmospheric phenomena being printed in black, that relating to the sea in blue: the direction, and in most cases also the force, of the wind for 5° squares and at a number of land-stations; the limits of the trade winds, and the average southern limit of the region in which gales exceed 10 per cent. of the wind observations; the mean tracks of cyclones for the month; the distribution of fog and ice. The trans-Atlantic steamer tracks and the outward and homeward sailing-routes to the equator are shown, and a large amount of letterpress containing information for the convenience of navigators is added. It is to be hoped that this Pilot Chart, and that now issued by the Deutsche Seewarte, will largely increase the interest taken by commanders and officers of ships sailing from this side of the Atlantic in the collection of meteorological information, which they alone have the opportunity of extending, and which is of the greatest value both to themselves and to science.

OBITUARY.

George Mercier Dawson, C.M.G., LL.D., F.R.S.

We have to announce with deep regret the death of our distinguished gold medalist Dr. George M. Dawson, Director of the Geological Survey of Canada, which took place at Ottawa, on March 2, after a short illness.

George Dawson was the son of the late Sir J. William Dawson, the well-known Canadian geologist and Principal of McGill University, Montreal, and was born at Pictou, Nova Scotia, on August 1, 1849. The love of natural science, and particularly of geology, proved to be hereditary, and without disparagement to the great abilities of the father, it may be said that the son surpassed him in his own special studies.

Although handicapped by difficulties that would have broken the spirit and embittered the heart of most men, George Dawson applied himself to study with a devotion and enthusiasm that ensured success in every department, while the geniality of his nature and the unselfish generosity with which he assisted his fellow-workers will remain as a cherished memory with all who knew him.

After attending the classes of the McGill University in Montreal, and deciding to take up geology as his special subject, Dawson came to London in 1869, and went through the three-years' course at the Royal School of Mines with high distinction. Returning to Canada, he proceeded to put his training to use, both by making mining surveys in Nova Scotia and by lecturing at Quebec. The Boundary Commission charged with fixing and marking out on the ground the 49th parallel from the Lake of the Woods to the Rocky Mountains, across the then almost unknown prairies, appointed him as geologist and botanist in 1873, and for two years he was engaged in exploring work, which was exactly to his mind. Intimate acquaintance with a vast stretch of country, including some of the most featureless and monotonous regions on the face of the Earth, quickened the powers of observation to a remarkable degree. In the general natural history observations also Dawson had an opportunity of recognizing the mutual dependence of all the phenomena which can be studied in the field, and thus he early acquired

broad views of geography which prevented him from ever falling into the narrower modes of thought of a specializing geologist. A voluminous report on the geology and resources of the country on the southern edge of western Canada was the permanent result of these two years' work.

Immediately afterwards Dawson was appointed to a post on the Dominion Geological and Natural History Survey, a service that has trained many able travellers.

The work in which he made his name as a geologist and as a traveller was the preliminary survey of the extreme western province and territories of the Dominion, from the international frontier to the Arctic Sea. Here he was a pioneer of geographical discovery as well as of geological investigation. His journeys were on a heroic scale, including many thousand miles of canoe travelling; and the comprehensiveness of the work done can only be realized from the official reports which were regularly published in the annual volumes issued by the survey. How wide and clear his views of the structure of Canada were may be best judged from the short but singularly luminous chapter on the physical geography of the Dominion, published in the 'Handbook' for the British Association meeting at Toronto in 1897. We know no better geographical description of any region, whether we consider the profound personal knowledge it displays or its clear and cautious generalizations.

The explorations of the Yukon district, which Dr. Dawson commenced in 1887, was the prelude to the development of the great mineral resources of that region; and his name has very appropriately been given to the chief centre of its mining activity. It illustrates the modesty of the man to recall that Dr. Dawson would never acknowledge that the town was named after him; when pressed with a direct question on one occasion, he said, "I think it must have been after some other Dawson, there are so many Dawsons in Canada!"

In 1892, Dr. Dawson was one of the commissioners appointed to investigate the question of seal-life in Bering Sea, with reference to the arbitration proceedings with the United States; and for his services in this matter he was made a C.M.G., and received the thanks of the Canadian Government. Other honours came to him in full measure, honorary degrees from the Canadian universities, and the presidency of the Royal Society of Canada, and of the Geological Section of the British Association, the gold medals of the Geological and of the Royal Geographical Societies, and the Fellowship of the Royal Society. In 1894, on the retirement of Dr. A. R. C. Selwyn, Dr. Dawson was promoted to be the Director of the Canadian Geological Survey. During his tenure of that office, he did all in his power to encourage his staff to undertake journeys of exploration, and the numerous papers published in our recent volumes by members of the Canadian Survey show how heartily the encouragement was responded to.

During the meeting of the British Association at Toronto in 1897, Dr. Dawson was indefatigable in helping the numerous visitors from Europe to make the most of their opportunities in seeing Canada. He himself accompanied one fortunate party across the continent in the special railway car *Chaudière*, and none who were privileged to take part in that memorable trip can ever forget the kindness he displayed. No question was asked by the most learned geologists of the party that could not be answered in a moment, backed with references to the Reports which dealt with the matter; no illustrative section, typical tree, or animal escaped observation; and there was no detail as to personal comfort too trifling to escape his anxious attention.

Dr. Dawson's whole life was a remarkable instance of entire devotion to duty, to the promotion of his chosen science, and to the welfare of the great Dominion whose resources he did so much to discover and render available.

CORRESPONDENCE.

The Rediscovery of Bariloche Pass.

In the February issue of the *Journal*, Señor Francisco P. Moreno labels as "incorrect" the statement published in the *Globus*, vol. 78, p. 182, *Petermanns Mitteilungen*, 1900, p. 218, and the *Geographical Journal*, vol. xvii. p. 79, as to the Bariloche (or more correctly Buriloche) pass having recently and finally been rediscovered by the Chilian Captain Arturo Barrios C. He further affirms that his own assistants effected this rediscovery in 1898, and brought back in proof of it photographs of both slopes of the gap.

The statement as formerly published is, however, perfectly correct. I do not dispute the existence of the gap called Bariloche on the Argentine "Evidence" maps (41° 24′ 30″ S. lat., 71° 54′ 30″ W. long.), but I am in position to prove that this gap does not lie on the old "Buriloche track." In the first place, it is not situated, as it appears on said maps, at the headwaters of Cochamó, as several parallel valleys and a lake (the real "Vidal Gormáz," as named by Christie) belonging to the Manso basin interpose. The want of room for these valleys on the Argentine map shows that no Argentine party has explored this region, and consequently cannot have ascertained whether the track lies there or not.

On the other side, the recent discovery on our part of an easily accessible pass near south of Tronador dispels any doubt as to the identification of the old track at the very place where the historical evidence led us to expect to find it.

The *famous Buriloche track* ("camino tan nombrado de Buriloche") of the Jesuit Father Olivares may be said now to have been re-explored in its entirety from Ralun, its true starting-point, at the northern extremity of the Reloncaví inlet, through Cayutúe, Rio Concha, Rio Blanco, and Buriloche valley to Lake Nahuelhuapi, the extent of the whole track being about 120 kilometres, of which only about 6 or 7 kilometres were explored in 1880 by Señor Moreno. An Argentine Commission penetrated, it is true, in 1898, by Lake Mascardi as far as its north-western extremity, where the path lies, but they do not seem to have discovered it, as they now claim to have found it so far from its true place. Meanwhile large sections of the Buriloche track, that had already been explored on the Chilian side at the end of the eighteenth century by Father Menendez, were re-explored by Señores Christie and Valverde in 1884 and 1885. Señor Fischer, in 1894, tried to find an easier path through the Cochamó valley, and partially succeeded; he re-explored this valley and two intermediate tributaries to the Rio Manso in 1898. Finally, in March and April, 1900, Captain Barrios, who was attached to the Chilian Boundary Commission, entering by the well-tracked path of the Cochamó valley, turned northward by the Rio Valverde, crossed over to the Rio Blanco basin by Rio Esperanza, identified the thermal waters of Buriloche, where Father Menendez camped on February 21, 1791, and passed over to the Buriloche or Rio Barros-Arana basin by a "low, wide, and easy pass" that we have called "Barrios pass," lying only 8 kilometres to the south of the summit of the gigantic Tronador, 41° 13′ 30″ S. lat. Between the north-western and north-eastern branches of Lake Mascardi, Captain Barrios made a short cut by an old track, reached the continental divide at "Mascardi pass," and from this point, an extent of only 25 kilometres, by the Argentine track, the shores of Nahuelhuapi, where he arrived on April 28.

Thus the different valleys and passes through which the Buriloche track lies have been successively explored and identified by two Chilian explorers: from Ralun to the Rio Blanco valley nearly as far as the thermal waters by Captain Valverde in 1885; and from this place as far as Nahuelhuapi by Captain Barrios

in 1900. Of the whole track only about the fifth part has actually been explored by Argentine parties; two-thirds of the valleys referred to are unknown to them, and the very existence of an accessible pass in the immediate vicinity of the Tronador is denied in the Argentine papers referred to by Señor Moreno.

The distinctive feature of the Buriloche track is the avoidance of any lake-crossing, there being no doubt that its reopening as a cattle-track would prove profitable to Chile as well as to Argentina.

More detailed information on this question will be found in the text as well as on the maps that are shortly to be submitted to the Arbitration Tribunal for solution of the boundary question, on the side of Chile.

ALEJANDRO BERTRAND.

London, February 16, 1901.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1900-1901.

Seventh Ordinary Meeting, February 25, 1901.—Sir T. H. HOLDICH, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

ELECTIONS.—*George Atkinson; D. Ronald Buchan; Captain Bruce Kingscmill, R.A.; Heneage Gibbes Wheeler.*

The Paper read was:—

"Some Aspects of South American Geography." By Colonel George Earl Church.

Eighth Ordinary Meeting, March 11, 1901.—Sir T. H. HOLDICH, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

ELECTIONS.—*James Henry Booth; S. H. Brooks; Captain Percy Harrison Fawcett, Royal Garrison Artillery; Lieut. Rowland Gibson, Dorset Regiment; Henry Hibbert; Charles Phodore Jacoby; Charles Lewall; William Glendowes Mackenzie; A. D. Milne, M.B., C.M., Uganda Medical Staff; Harry Nuttall; John Parkinson, F.G.S.; Lester Ralph; Granville H. Ramage; Robert Graham Rogerson, C.E.; William H. Williams.*

MR. FREDERICK PULLAR.

The CHAIRMAN said: It is with regret that I have to announce the death of one of our members, Mr. Frederick Pullar, who you may possibly remember has, conjointly with Sir John Murray, contributed papers to the *Journal* of the Society on the Highland lochs of Scotland. It is, perhaps, with a melancholy sense of the fitness of things that we have to recall that he found his death in one of his own beloved lochs, while gallantly attempting to save the life of a young lady who had fallen through the ice. His memory is one which I am sure the Society will always honour. He was a brave man, and he will always be remembered by us, not only for his own personal worth and bravery, but as a most valuable contributor to the pages of our *Journal*.

The Paper read was:—

"The Geography of the North-West Frontier of India." By Sir Thomas H. Holdich, R.E., K.C.I.E., C.B.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Botany. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 8–14. **Wettstein.**
Die wissenschaftlichen Aufgaben alpiner Versuchsgärten. Von Prof. Dr. R. v. Wettstein.

Alps of Carinthia. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 362–394. **Steinitzer.**
Die Carnischen Voralpen. Von H. Steinitzer. *With Map and Illustrations.*
A general account of the Carnic Alps, with notes on their physical and human geography.

Alps—Föhn. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 61–79. **Klein.**
Der Nordföhn zu Tragöss. Ein Beitrag zur Wetterkunde der Ostalpen. Von Dr. Robert Klein. *With Map and Illustration.*

Alps—Ifen. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 52–60. **Eckert.**
Das Gottesackerplateau (ein Karrenfeld) in der Gebirgsgruppe des Hohen Ifen. Von Dr. Max Eckert.

Alps—Orography. *B.S.G. Italiana* **1** (1900): 776–813, 873–928, 984–1006. **Marinelli.**
Studi orografici nelle Alpi Orientali. Del Prof. Olinto Marinelli. *Illustr.*

Alps—Pitzthal. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 110–136. **Schucht.**
Das Pitzthal. Von Richard Schucht. *With Illustrations.*

Alps—Rhätikon. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 42–51. **Rothpletz.**
Geologische Wanderungen im Rhätikon. Von A. Rothpletz.

Alps—Sella group. **Bindel.**
Z. Deutsch. u. Österreich. Alpenv. **30** (1899): 359–400; **31** (1900): 324–361.
Die Sellagruppe. Von Dr. Karl Bindel. *With Map and Illustrations.*
This profusely illustrated monograph does not appeal only to tourists, but deals with the Sella group from the points of view of geology, orography, hydrography, flora, ethnography, etc., and ends with a full bibliography.

Alps—Sonnblick. **Machaček.**
Zur Klimatologie der Gletscherregion der Sonnblickgruppe. Von Dr. Fritz Machaček. (Aus dem achten Jahres-Berichte des Sonnblick-Vereines für das Jahr 1899.) Size 11½ × 7½, pp. 34. *Diagrams. Presented by the Author.*

Alps—Structure. *Nature* **63** (1901): 294–296. **Ogilvie-Gordon.**

An Alpine Crust-Basin. By Dr. Maria M. Ogilvie-Gordon.

Review of two works by Prof. Rothpletz, dealing with the boundary district between the Eastern and Western Alps.

Alps of Tirol. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 300–323. **Christomannos.**

Die Latemargruppe. Von Dr. Th. Christomannos. *With Map and Illustrations.*

The Latemar group, here described in detail, lies nearly due north of Predazzo, in the Tirol.

Alps—Zugspitze. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 1–7. **Burkhard.**

Das Observatorium auf der Zugspitze. Von Wilhelm Burkhard. *With Plate.*

Austria—Aquileja. *Tour du Monde* **6** (1900): 577–588. **Martel.**

Aquileja (Autriche). Par M. E. A. Martel. *With Illustrations.*

Aquileja, or Aglar, was one of the principal cities of Northern Italy, until destroyed by Attila in 452 A.D.

Austria—Bohemia. *Petermanns M.* **46** (1900): 290–292. **Uhlig.**

Geologische Karte des Böhmischen Mittelgebirges. Von Prof. Dr. V. Uhlig.

On the first three sheets, lately issued, of a geological map of the eruptive ranges of Central Bohemia, with text by J. E. Hibsch.

Austria—Herzegovina. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 25–41. **Penck.**

Geomorphologische Studien aus der Herzegowina. Von Albrecht Penck. *With Illustrations.*

Austria-Hungary. *Z. Ges. Erdk. Berlin* **35** (1900): 286–296. **Stavenhagen.**

Ueber das neueste Militär-Kartenwesen Oesterreich-Ungarns. Von W. Stavenhagen.

Austria—Karst. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 97–109. **Müller.**

Die Kačna jama im Karst bei Divača. Von Friedrich Müller. *With Plan.*

On the exploration of a portion of the underground course of the Reka.

Austria—Lakes. **Müllner.**

Die Seen am Reschen-Scheideck. Eine limnologische Studie von Prof. Dr. Johann Müllner. (Geographische Abhandlungen, herausgegeben von Prof. Dr. Albrecht Penck. Band vii.—Heft 1.) Wien: E. Hölzel, 1900. Size 10 × 7½, pp. 46. *Maps and Profiles. Presented by Dr. Penck.*

This will be specially noticed.

Belgium. **Raikes.**

Trade, Finances, etc., of Belgium for the year 1899. Foreign Office, Annual No. 2515, 1900. Size 10 × 6½, pp. 26. *Price* 2*d.*

Denmark—Meteorology. ———

Annuaire météorologique pour l'année 1897. Publié par l'Institut météorologique Danois. Deuxième partie (pp. 98).—Ditto 1899. Première partie. Kjøbenhavn: G. E. C. Gad, 1900. Size 14 × 9½, pp. 140.

Ethnological—Stone implements. **Giglioli.**

Intorno ad alcuni strumenti litici recentemente o tuttora in uso nell' Europa. Nota del Prof. Enrico H. Giglioli. (Estratto dall' *Archivio per l'Antropologia e l'Etnologia*, vol. xxix., Fasc. 3°, 1899.) Size 10 × 7, pp. 12. *Illustrations. Presented by the Author.*

France. *C. Rd.* **131** (1900): 1056–1059. **Jonquières.**

Note sur le Bois de Boulogne. Par M. Barras. Rapport de M. de Jonquières.

France—Ain. **Corcelle.**

Géographie du Département de l'Ain. Par M. J. Corcelle. Bourg, 1900. Size 9½ × 6½, pp. 84. *Map, Plan, and Illustrations. Presented by the Author.*

This is a careful study of the geography of the department of Ain, based on personal investigations. The department, which the writer has traversed in all directions, includes five distinct natural regions or "pays," recognized by popular nomenclature, though somewhat arbitrarily united into one administrative division in 1789.

France—Sea Fishery. *G.Z.* **6** (1900): 696–701. **Lindeman.**

Die französische Seefischerei. Von Dr. Moritz Lindeman. *Also separate copy, presented by the Author.*

Germany. *Rev. G.* **45** (1899): 401; **46** (1900): 1, 86, 164, 268, 336, 424; **47** (1900): 22, 90, 188, 258, 324, 415. **Drapeyron.**

A travers l'Allemagne du Nord. Par L. Drapeyron.

This paper is intended to illustrate the use of geography for the study of history.

Germany—Brocken. *M.V. Erdk. Halle* (1900): 63–83. **Kirchhoff and Stade.**

Der Brocken als Geisterberg. Von Prof. Dr. A. Kirchhoff.

Winterbilder vom Brocken. Von Dr. H. Stade.

Germany—Elbe. *M.V. Erdk. Halle* (1900): 51–62. **Lorenz.**

Die Hydrographie des Elbsystems nach G. v. Alvenslebens Topographie. Von Dr. G. Lorenz.

The various passages on the hydrography of the Elbe system contained in Gebhard von Alversleben's 'Topographie Erzstiftes Magdeburg' (1655), are here collected.

Germany—Prussian Saxony. *M.V. Erdk. Halle* (1900): 22–54. **Schmidt.**

Die Siedelungen an der Hainleite, Schmücke-Schrecke und Finne. Von Dr. M. G. Schmidt.

In this district, which lies between the Harz and Thüringerwald, the separate periods of settlement within historic times can be distinguished by the characteristic terminations of the place-names.

Germany—Silesia. *Globus* **78** (1900): 297–300, 321–325, 338–342. **Tetzner.**

Die Tschechen und Mährer in Schlesien. Von Dr. F. Tetzner. *With Illustrations.*

Germany—Thüringerwald. *M.V. Erdk. Halle* (1900): 1–22. **Gerbing.**

Die frühere Verteilung von Laub- und Nadelwald im Thüringerwald. Von Luise Gerbing. *With Map.*

With a gradual extension of coniferous at the expense of deciduous forests in many districts—an extension likely to be carried yet further in the future—the author thinks that no radical change can be traced within historic times. See *ante*, p. 426.

Germany—Thuringia. *M.V. Erdk. Halle* (1900): 83–87. **Toepfer.**

Phänologische Beobachtungen in Thüringen 1899. Von Dr. H. Toepfer.

Statistics of dates of blossoming, fruiting, etc., for forty-one species of trees and shrubs at six different stations.

Germany—Würtemberg. **Rose.**

Trade, Agriculture, and Finances of Würtemberg for the year 1899 and part of 1900. Foreign Office, Annual No. 2532, 1900. Size 9½ × 6, pp. 38. *Price* 2½*d.*

Greece—Earthquakes. *Petermanns M.* **46** (1900): 277–284. **Mitzopulos.**

Die Erdbeben von Tripolis und Triphylia in den Jahren 1898 und 1899. Von Prof. C. Mitzopulos. *With Map and Plan.*

Holland—Diluvium. **Cappelle.**

Verh. K.A. Wetens. Amsterdam (2 Sec.) **7**, No. 3 (1900): pp. 26.

Mededeelingen omtrent de Geologie van Nederland, verzameld door de Commissie voor het geologisch onderzoek. No. 27. Nieuwe waarnemingen op het Nederlandsche diluviaalgebied, voornamelijk met het oog op de kaarteering dezer gronden. (II.) Door H. van Cappelle. *With Map.*

This treats of the moraine deposits, heath-sand, and loess of the Veluve district in North Guelderland.

Iceland. **Vidalin.**

Trade of Iceland for the years 1897–99. Foreign Office, Annual No. 2530, 1900. Size 10 × 6½, pp. 20. *Price* 1½*d.*

Italy—Sicily. **Garston.**

Trade of Sicily for the year 1899. Foreign Office, Annual No. 2529, 1900. Size 10 × 6, pp. 66. *Price* 3½*d.*

British shipping is being gradually superseded at Palermo by foreign vessels, except where, as in the carrying trade to America, large vessels are required.

Mediterranean—Cyprus. *G.Z.* **6** (1900): 679–696. **Maas.**

Cypern von heute. Von Dr. Otto Maas.

An instructive sketch of the physical and social conditions of Cyprus. The author recognizes the difficulties which the British administration has had to face, and gives on the whole an encouraging picture of progress.

Mediterranean—Cyprus. *J.R. United Service I.* **44** (1900): 1438–1449. **Prinsep.**

A Journey in Cyprus, 1899. By Major D. G. Prinsep. *With Illustrations.*

Northern Europe. **Du Chaillu.**

The Land of the Long Night. By Paul Du Chaillu. London: John Murray, 1900. Size 8½ × 6, pp. xviii. and 266. *Illustrations. Price 7s. 6d. Presented by the Publisher.*

In this volume the author tells, in his own inimitable style, the story of his winter wanderings in the far north, for the special benefit of young people.

Norway—Climate. ——

Climate [of Norway]. [Reprint from Norway (Official Publication for the Paris Exhibition, 1900).] Size 10 × 7, pp. [14]. *Map.*

Norway—Fishery and Marine Investigations. **Hjort.**

Report on Norwegian Fishery and Marine Investigations. Vol. i. Edited by Johan Hjort. Kristiania: Oscar Andersens Bogtrykkeri, 1900. Size 11 × 7½, pp. 214, 56, 42, 46, 30, 92, xxxviii., 14, 58, and 24. *Maps and Plates. Presented by the Editor.*

Norway—Meteorology. **Mohn.**

Jahrbuch des Norwegischen Meteorologischen Instituts für 1899. Herausgegeben von Dr. H. Mohn. Christiania, 1900. Size 13½ × 10½, pp. xii. and 122.

River Systems. *Petermanns M.* **46** (1900): 167–170, 192–194. **Bludau.**

Die Areale der europäischen Stromgebiete. Von Dr. Alois Bludau. III. Die Donaustaaten und die Donau.

Russia—Solovetsk. *P. Philosoph. S. Glasgow* **31** (1900): pp. 67–106. **Mavor.**

A Pilgrimage to Solovetsk. By Sam. Mavor. *Illustrations. Also separate copy. Presented by the Author.*

Account of a voyage in 1899 to the monastery of Solovetsk, on an island in the White sea, with interesting particulars on the present state of the Murman coast.

Russian Empire. **Kovalevsky.**

Commission Impériale de Russie à l'Exposition Universelle de Paris. La Russie à la fin du 19e Siècle. Ouvrage publié sous la Direction de M. W. de Kovalevsky. Paris: P. Dupont, 1900. Size 10 × 6½, pp. xx. and 990. *Maps and Diagrams. Presented by M. de Tatistcheff.*

A most valuable account of the present condition of the Russian Empire, its agriculture, industries, commerce, communications, etc., by a large number of experts.

Sailing Directions. *Nautical Mag.* **69** (1900): 747–750. **White.**

'The Rutter of the Sea.' (By Robert Copland.) With Notes by J. Dundas White.

A brief description of the earliest book on navigation in the English language, with reprint of the prologue. The 'Rutter' was a translation from a French original published at the beginning of the sixteenth century (Mr. White, by a slip, says fifteenth), which is thought by some to have been the work of Pierre Garcie, author of the 'Grant Routier,' which appeared later.

Spain. **Dieulafoy.**

Madame Jane Dieulafoy. Aragon and Valence, Barcelone, Saragosse, Sagonte, Valence. Les Beaux-Arts, les Mœurs, les Coutumes. Paris: Hachette & Cie., 1901. Size 12½ × 9, pp. 148. *Illustrations. Presented by the Publishers.*

A profusely illustrated popular account of two of the provinces of Spain, with especial reference to their people and works of art, ancient and modern.

Switzerland. *XVII. Jahresb. G. Ges. Bern* (1898-99): 121–146. **Brückner.**

Die Schweizerische Landschaft einst und jetzt. Von Prof. Dr. Eduard Brückner.

On the geological history of Switzerland.

Travel. **Taylor.**

Odd Bits of Travel with Brush and Camera. By Charles M. Taylor, jun. Philadelphia: G. W. Jacobs & Co., 1900. Size 8 × 5½, pp. 358. *Illustrations. Presented by the Author.*

A pleasantly written account of travel in Western Europe, especial attention being given to the old-world towns and villages of Holland and the Rhine. The tints in which the illustrations are printed are not always artistic.

United Kingdom. *Quarterly J. R. Meteorolog. S.* **26** (1900): 113–138. **Mawley.**

Report on the Phenological Observations for 1899. By Edward Mawley. *Map.*

On the dates at which the phenomena of budding, flowering, fruiting, etc, of plants, and the movements of migratory birds, etc., were observed.

United Kingdom. **Yates.**

Collins' School Series. Collins' Alternative Geography Reader. By M. T. Yates, LL.D. Book II.—Standard V. The British Isles. London and Glasgow: W. Collins, Sons, & Co. Size 10 × 7½, pp. 196. *Maps and Illustrations. Price* 2*s. Presented by the Publishers.*

A distinct advance on many of the readers now in use.

United Kingdom—Egg Supply. *J.R. Agricultural S.* **11** (1900): 605–645. **Brown.**

The British Egg Supply. By Edward Brown. *With Illustrations.*

The writer shows the enormous increase of our imports of eggs of late years, and dwells on the need of a revolution in home methods of poultry farming.

United Kingdom—Manchester. *J.R.I. Brit. Architects* **7** (1900): 453–464. **Oakley.**

Manchester: Some Notes on its Development. By Frank P. Oakley. *Illustr.*

A comparison of Manchester in 1800 with Manchester in 1900.

United Kingdom—Scotland. **Watt.**

Scottish Forests and Woodlands in Early Historic Times. By H. B. Watt. (Reprinted from *Annals of the Andersonian Naturalists' Society*, vol. ii. part ii. Glasgow, 1900.) Size 9 × 6, pp. [20]. *Presented by the Author.*

The author endeavours, from a study of the history of Roman and later times, as well as from topographical and traditional evidence, to estimate the former extent of Scottish woodlands.

ASIA.

China—Mongolia. **Radloff.**

Arbeiten der Orchon-Expedition. Atlas der Alterthümer der Mongolei. Im auftrage der Kaiserlichen Akademie der Wissenschaften herausgegeben von Dr. W. Radloff. Vierte Lieferung. St. Petersburg, 1899. Size 20½ × 13½. *Plates. Presented by the Academy.*

This instalment consists of photographs of monuments and old Turkish inscriptions from the burial-place on the Tonjukuk.

China—Pe-Chi-li. ——

Supplement to Short Military Report on the Province of Chi-li. Compiled in the Intelligence Branch of the Quarter-Master General's Department, Simla. I.—A short Note on the Operations of the Allied Forces in Chi-li in 1860. II.—The Operations of the British Cavalry in Chi-li during August and September, 1860. Simla, 1900. Size 10 × 6½, pp. 8. *Map.*

China—Religions. *Nineteenth Century* **48** (1900): 373–384, 569–581, 730–742. **Müller.**

The Religions of China. By the Right Hon. Professor Max Müller.

China—Shantung. *Petermanns M.* **46** (1900): 273–277. **Anz.**

Durch die Halbinsel Schantung von Tschifu nach Tsingtau 1. bis 6. März 1899. Von Walter Anz. *With Map.*

China—Stone age. **Giglioli.**

L'età della pietra nella Cina colla descrizione di alcuni esemplari nella mia collezione. Appunti di Enrico H. Giglioli. (Estratto dull' *Archivio per l'Antropologia e l'Etnologia*, vol. xxviii., fasc. 3°, 1898.) Size 10 × 7, pp. 20. *Illustrations. Presented by the Author.*

India. *Contemporary Rev.* **78** (1900): 682–692. **Nash.**

An Empire Adrift. By Vaughan Nash.

On the present condition of the Indian ryots.

India—Assam. **Carr-Calthrop.**

Annual Sanitary Report of the Province of Assam for the year 1899. By Colonel C. W. Carr-Calthrop, M.D. Shillong, 1900. 13½ × 8½, pp. 38, xxx., and 4. *Maps.*

India—Assam. ——

Returns of the Rail and River-borne Trade of the Province of Assam for the quarter ending June 30, 1900. Shillong, 1900. Size 13½ × 8½, pp. 132.

India—Bombay. *J. Bombay Br. R. Asiatic S., Extra Nr.* (1900): pp. 368. **Da Cunha.**

The Origin of Bombay. By J. Gerson da Cunha.

An exhaustive account of Bombay in the Hindu, Portuguese, and British periods.

India—Botanical Survey.

Report of the Director of the Botanical Survey of India for the year 1899–1900. Size 13½ × 8½, pp. 10.

Among the most interesting botanical work done during the year was a collection by Lieut. Gage from the Lushai country, previously unexplored botanically.

India—Fisheries. **Thurston.**

The Sea Fisheries of Malabar and South Canara. By Edgar Thurston. (Madras Government Museum. Bulletin, vol. iii. No. 2.) Madras, 1900. Size 8½ × 5½, pp. 93–184. *Illustrations.*

India—Himalayas. **Freshfield.**

Round Kanchinjinga. (From *Country Life Illustrated*, Aug. 25, 1900, pp. 233–239.) Size 15 × 9½. *Illustrations.*

Extracts from Mr. Freshfield's paper at the Alpine Club, illustrated by selections from the mountain photographs there exhibited.

India—Kashmir. **Francke.**

Ladâker mythologische Volkssagen. Von H. Francke. (Sonder-Abdruck aus Band lxxvi., Nr. 20 des *Globus*, pp. 313–315.) Braunschweig, 1899. Size 12½ × 9.

India—Water Supply. *Imp. and Asiatic Quarterly Rev.* 11 (1901): 35–45. **Sowerby.**

Water-Supply in Mitigation of Drought in India. By William Sowerby.

Indian Ocean—Seychelles. **Escott.**

Seychelles. Report for 1899. Colonial Reports, Annual No. 301, 1900. Size 9½ × 6½, pp. 50. *Price* 3*d.*

The increasing prosperity of the islands is shown by the fact that customs receipts have doubled since 1895. The systematic working of the valuable guano deposits on the Amirantes has been taken in hand.

Japan. **Firth.**

Agriculture and Horse and Cattle Breeding in Kagoshima Prefecture, Japan. Foreign Office, Miscellaneous, No. 539, 1900. Size 10 × 6½, pp. 10. *Price* 1*d.*

The district under review is hilly, and five-sixths of the cultivated area consists of "hata," or upland fields. Of a population of 1,090,000, 500,000 are wholly dependent on agriculture.

Malay Archipelago. *Petermanns M.* 46 (1900): 182–191. **Weber.**

Die niederländische *Siboga*-Expedition zur Untersuchung der marinen Fauna und Flora des Indischen Archipels und einige ihrer Resultate. Von Prof. Dr. Max Weber.

An abstract of this paper appeared in the *Journal*, vol. xvi. p. 549.

Malay Archipelago.

Tijds. K. Ned. Aard. Genoots. Amsterdam 17 (1900): 427–530.

De Siboga-Expeditie. Door L.

Malay Archipelago—Celebes. **Sarasin.**

XVII. Jahresb. G. Ges. Bern. (1898–99): 65–94.

Ueber unsere Reisen im Innern von Celebes. Von Paul Sarasin. *With Map.*

This paper was read in May, 1898.

Persia. **Temple.**

Trade of Khorassan for the year 1899–1900. Foreign Office, Annual No. 2533, 1900. Size 10 × 6½, pp. 14. *Price* 1*d.*

The imports of tea, both from India and Russia, and of sugar from Russia, show a considerable increase. Exports to India are still small, but to Russia are very large. The population of Meshed continues to increase steadily.

Philippine Islands. *National G. Mag.* 11 (1900): 465–470. **Hilder.**

Gold in the Philippines. By F. F. Hilder.

The writer here records information received from reliable sources during a visit to the Philippines in 1900.

Philippine Islands. **Hitchcock.**

Trade of the Philippine Islands. By Frank H. Hitchcock. (U.S. Department of Agriculture. Section of Foreign Markets. Bulletin No. 14.) Washington, 1898. Size 9½ × 6, pp. 160. *Map. Presented by the U.S. Department of Agriculture.*

Siam. **Carlisle.**

Trade of Bangkok and District for the year 1899. Foreign Office, Annual No. 2528, 1900. Size 10 × 6½, pp. 18. *Price* 1½*d.*

The total volume of the foreign trade of Bangkok was £5,655,912 in 1899, as compared with £5,913,302 in 1898, the decrease being accounted for by the decreased export and import of treasure.

Russia—Siberia. *XVII. Jahresb. G. Ges. Bern.* (1898-99): 1-63. **Jochelson.**

Die Jukagiren im äussersten Nordosten Asiens. Von W. Jochelson. *Illustr.*

Ueber die Sprache und Schrift der Jukagiren. Von W. Jochelson. *Illustr.*

On an aboriginal race dwelling between the Lena and the Stanovoi range.

Russia—Siberia—Railway.

Pariser Weltausstellung d. J. 1900. Die grosse Sibirische Eisenbahn. Herausgegeben von der Kanzlei des Ministercomitees. St. Petersburg, 1900. Size 10½ × 7, pp. 16. *Maps and Portrait. Price* 1*s.* 6*d.*

Russia—Transcaucasia. *Z. Deutsch. u. Osterreich. Alpenv.* **31** (1900): 156-178. **Rickmers.**

Der Kartsch-Chal in Transkaukasien. Von Willy Rickmer-Rickmers. *Illustr.*

The Kartsch-Chal is a mountain group 30 miles from Batum, explored by the author in 1895.

Russia—Trans-Caucasia. **Stevens.**

Agriculture in the Trans-Caucasus, 1900. Foreign Office, Annual No. 2534, 1900. Size 10 × 6, pp. 14. *Price* 1*d.*

Agriculture in the Trans-Caucasus is said to be still in a backward state. Among the industries referred to are the cultivation of tea, tobacco, the vine, silk, etc. The silk industry has assumed large proportions during recent years.

Siberia and Manchuria. **Colquhoun.**

J.R. United Service I. **44** (1900): 1408-1430; *Monthly Rev.* (1900): 40-55.

The Great Trans-Siberian-Manchurian Railway. By A. R. Colquhoun. *Maps.*

South-East Asia—Historical. **Gerini.**

Imp. and Asiatic Quarterly Rev. **10** (1900): 365-394; **11** (1901): 155-170.

Siam's Intercourse with China (Seventh to Nineteenth Centuries). By Major G. E. Gerini.

The author brings forward some new facts, based on Chinese records, regarding the early spread of Buddhism in Indo-China.

Turkey—Syria. **Serruys.**

Notice sur le Liban. Par Washington Serruys. Beyrouth, 1900. Size 8½ × 6, pp. 46. *Presented by the Author.*

A useful account of the Lebanon in its present condition, with statistics.

AFRICA.

British South Africa. *Contemporary Rev.* **78** (1900): 669-675. **White.**

Concerning South African Settlers. By Arnold White.

On the conditions to be fulfilled by schemes for the settlement of South Africa.

Canary Islands. *Globus* **78** (1900): 365-370. **Krämer.**

Ein Besuch von Gran Canaria. Von Dr. Augustin Krämer. *With Illustrations.*

The visit was made in 1899-1900.

Central Africa. *Mouvement G.* **17** (1900): 483-486, 495-498. **Kandt.**

Aux frontières du Congo. L'exploration du Dr. Kandt.

An editorial note discusses the question of the source of the Nile, which is held to be the Victoria Nyanza rather than the source of any river flowing into it. The *rôle* played by the Kagera is perhaps unduly depreciated, for there can be little doubt that, were the lake drained by the wearing down of its barrier, the river would still find its way to the Nile, whereas if the Kagera were diverted from the lake, the latter would soon cease to have an outlet.

Central Sudan. *Imp. and Asiatic Quarterly Rev.* **11** (1901): 82-97. **Edwards.**

An African Napoleon. By F. A. Edwards.

Describes the victorious career and final overthrow of Rabeh, or Rabah.

Congo State. *Mouvement G.* **17** (1900): 388-390, 398-401, 413-415, 427-429. ——

Etat indépendant du Congo. Rapport au Roi-Souverain.

On the condition and progress of the Congo State in 1900.

Congo State—Katanga. *Mouvement G.* **17** (1900): 601-606. **Wauters.**

Au Katanga. Par A. J. Wauters. *With Map.*

A sketch of the recent development of the south-east portion of the Congo state.

Congo State—Navigation. *Mouvement G.* **18** (1901): 1-4. **Wauters.**

La navigation à vapeur sur le haut Congo. Par A. J. Wauters.

The number of steamers on the upper Congo and its affluents now reaches 103, of which 39 are French, 31 Congo State, 17 Belgian, 10 Dutch, 3 British, 2 German, and 1 American.

Egypt—Oases. **Guest.**

Report on the Oases of the Mudiriyeh of Assyut. By A. R. Guest. Cairo: National Printing Department, 1900. Size 11 × 7½, pp. 42. *Maps. Presented by the Author.*

An abridged version of this report appeared in the *Journal* for December last.

Egypt—Oases. **Guest.**

The Oases of the Mudirieh of Assyut. By A. R. Guest. (From the *Geographical Journal* for December, 1900.) Size 10 × 6½, pp. 8. *Map and Illustrations.*

Egypt—Public Works Department. **Garstin.**

Public Works Ministry. Report upon the Administration of the Public Works Department for 1899. By Sir W. E. Garstin, K.C.M.G. With Reports by the officers in charge of the several branches of the Administration. Cairo, 1900. Size 11 × 7½, pp. 324. *Plans and Illustrations. Presented by the Author.*

This is referred to at p. 307, *ante*.

French Guinea—Futa Jallon. **Machat.**

Renseignements Colon., Comité l'Afrique Française, No. 7 (1900): 125-145.

Essai sur la géographie du Fouta-Diallon. Par M. J. Machat. *With Map.*

French West Africa. **Hostains and d'Ollone.**

B. Comité l'Afrique Française **10** (1900): 327-332, 382-383, 390-392.

La mission Hostains-d'Ollone. *With Portraits and Illustrations.*

Account of the recent French expedition from the Ivory coast to the Sudan.

French West Africa—Niger. *Rev. G.* **47** (1900): 359-373, 436-451. **Lenfant.**

La flottille du Niger. Notes rapides d'inspection fluviale. Par E. Lenfant. *With Sketch-maps.*

On a reconnaissance in 1899 of the upper and middle Niger, by the officer lately entrusted with the occupation of the French *enclaves* on the lower river.

Gambia. **Llewelyn.**

Gambia. Report for 1899. Colonial Reports, Annual No. 300, 1900. Size 10 × 6½, pp. 8. *Price ½d.*

In 1899 three-fourths of the total exports, which reached a value of £241,936, went to France, the greater part consisting of ground-nuts. The export of rubber has much decreased owing to the practical extinction of the rubber plants.

German West Africa—Togo. **Canstatt.**

Deutsch. Kolonialzeitung **17** (1900): 551, 578-580.

Die gewerblichen Erzeugnisse des Togogebiets. Von D. O. Canstatt. *Illustrations.*

On the native industries of Togoland.

Italian Somali Coast. **Dulio.**

I Commerci del Benadir. Relazione del comm. E. Dulio. (B. Ministero Affari Esteri, Sept. 1900.) Roma, 1900. Size 9½ × 6½, pp. 32.

Liberia. **Delafosse.**

Renseignements Colon., Comité l'Afrique Française, No. 9 (1900): 165-194.

Un État nègre: La République de Libéria, notice géographique, historique, économique et ethnographique. Par M. Maurice Delafosse. *Map and Illustr.*

A useful summary of our knowledge of Liberia, from personal observation.

Madagascar. **Grandidier.**

Voyage dans le Sud-ouest de Madagascar, Conférence faite à la Société de Géographie le 5 janvier 1900. Par Guillaume Grandidier. Paris, 1900. Size 10 × 6½, pp. 28. *Map and Illustrations. Presented by the Author.*

On a journey in 1898 from Tulear, on the south-west coast, to Fianarantsoa, on the headwaters of the Mangoka. The map is on the large scale of 1 : 500,000.

Madeira. **Spence.**

Trade of Madeira for the year 1899. Foreign Office, Annual No. 2517, 1900. Size 10 × 6½, pp. 8. *Price* ½*d.*

Marocco. *Petermanns M. Ergänzungsheft Nr.* 133 (1900): 166. **Fischer.**

Wissenschaftliche Ergebnisse einer Reise im Atlas-Vorlande von Marokko. Von Theobald Fischer. *With Maps and Illustrations.*

Full results of the journey referred to in the *Journal*, xiii. 660, xiv. 209.

Nigeria—Hausa Dictionary. **Robinson and Brooks.**

Dictionary of the Hausa Language. By Charles Henry Robinson, M.A., assisted by W. H. Brooks, B.A. Vol. ii. English-Hausa. Cambridge: the University Press, 1900. Size 9 × 6, pp. viii. and 218. *Price* 9*s. net. Presented by the Royal Niger Co.*

North-East Africa. **Smith.**

An Expedition between Lake Rudolf and the Nile. By Dr. A. Donaldson Smith. (From the *Geographical Journal* for December, 1900.) Size 10 × 6½, pp. 26. *Map and Illustrations.*

Sahara. *Questions Dipl. et Colon.* **10** (1900): 721–742. **Foureau.**

De la Méditerranée au Congo. Par F. Foureau. *With Map.*

A reproduction of M. Foureau's paper at the Paris Geographical Society.

Sierra Leone. **Meagher.**

Sierra Leone. Report for 1899. Colonial Reports, Annual No. 299, 1900. Size 9½ × 6½, pp. 46. *Price* 2½*d.*

The trade of Sierra Leone has not yet completely recovered from the late disturbances. The export of palm-kernels shows an increase, but a diminution in the case of most articles from the interior is the result of a diversion of trade to French ports. The transit trade in cotton goods to French Guinea has practically ceased.

Tripoli. **Jago.**

Agriculture and other Natural Resources of Tripoli. Foreign Office, Miscellaneous, No. 527, 1900. Size 10 × 6½, pp. 26. *Price* 2*d.*

Begins with a clear sketch of the Physical Features of Tripoli.

West Africa—Boundaries. *Rev. Française* **25** (1900): 544-548. **Montell.**

Convention Franco-Espagnole en Afrique. Par M. A. Montell. *With Maps.*

West Africa—Boundaries. *B. Comité l'Afrique Française* **10** (1900): 279-280. ——

La Convention de délimitation franco-espagnole. *With Maps.*

NORTH AMERICA.

Canada—French. *Nineteenth Century* **48** (1900): 777–784. **Cox.**

French Canada and the Empire. By J. G. Snead Cox.

Canada—Geological Nomenclature. **Ells.**

P. and T.R S. Canada **5** (1899) (Sec. iv.): 3–38.

Presidential Address: Canadian Geological Nomenclature. By R. W. Ells, LL.D.

A review of the history of geological nomenclature in Canada, and of the problems awaiting solution.

Canada—Historical. *P. and T.R.S. Canada* **5** (1899) (Sec. ii.): 359–421. **Doughty.**

The probable Site of the Battle of the Plains of Abraham. By A. G. Doughty. *With Plans and Illustrations.*

A careful and unbiased discussion of the question of the exact site of the battle which decided the fate of Canada, based on the study of old plans and documents. The author places it between Claire Fontaine Street and de Salaberry Street.

Canada—Historical. *P. and T.R.S. Canada* **5** (1899) (Sec. I.): 87–101. **Girouard.**

Une Page sombre de notre Histoire—L'Expédition du Marquis de Denonville. Par M. le juge Girouard.

On some new documents relating to the expedition of Denonville against the Iroquois, 1687.

Canada—Minerals. ———

Geological Survey of Canada. Part S, Annual Report, vol. xi. Section of Mineral Statistics and Mines. Annual Report for 1898. Ottawa, 1900. Size 10 × 6½, pp. 196. *Maps. Presented by the Geological Survey of Canada.*

Canada—New Brunswick. **Ganong.**

P. and T.R.S. Canada **5** (1899) (Sec. ii.): 213–357.

A Monograph of Historic Sites in the Province of New Brunswick. By W. F. Ganong. *With Maps and Plans.*

Canada—New Brunswick. **Miller.**

New Brunswick, Past and Present. By C. A. Duff Miller. Size 8½ × 5½, pp. 32. *Portrait. Presented by the Author.*

An interesting sketch of the history and present condition of New Brunswick.

Canada—Newfoundland. *Rev. G.* **47** (1900): 401–414. **Harrisse.**

Découverte et évolution cartographique de Terre-Neuve et des pays circonvoisins, 1497, 1500, 1769. Par Henry Harrisse.

An outline of M. Harrisse's new work, lately published in Paris.

Canada—Notre Dame Mts. *B. American Bureau G.* **1** (1900): 275–279. **Dresser.**

On the Physical Geography of a Northern Section of the Appalachian Mountain System. By J. A. Dresser.

Written from an educational point of view.

Canada—Nova Scotia. *P. and T.R.S. Canada* **5** (1899) (Sec. ii.): 1–197. **Bourinot.**

Builders of Nova Scotia: A Historical Review, with an Appendix containing Copies of Rare Documents relating to the Early Days of the Province. By Sir John G. Bourinot, K.C.M.G. *With Portraits and Illustrations.*

Canada—Nova Scotia. *P. and T.R.S. Canada* **5** (1899) (Sec. iii.): 23–26. **Dawson.**

Illustrations of remarkable Secondary Tidal Undulations, in January 1899, as registered on recording Tide Gauges in the region of Nova Scotia. By W. Bell Dawson. *With Plate.*

Canada—Rocky Mts. *Z. Deutsch. u. Österreich. Alpenv.* **31** (1900): 137–155. **Habel.**

Aus den Alpen Nordamerikas. Von Jean Habel. *With Illustrations.*

On recent journeys in the source region of the North Fork of the Saskatchewan.

Canada—Trigonometrical Survey. **McLeod.**

P. and T.R.S. Canada **5** (1899) (Sec. iii.): 3–7.

A Trigonometrical Survey for Canada; Presidential Address to Section. By Prof. C. H. McLeod.

An appeal for a complete geodetic survey of Canada as an extension of the scheme for the measurement of an arc of 98th meridian.

Canada—Yukon Territory. **Brown.**

The Dawson of To-day. By F. F. Brown. (The *Yukon Sun*, Special Number, September, 1900.) Dawson. Size 11 × 9. *Illustrations.*

Canada and United States. *T. Hist. and Sci. S. Manitoba* **56** (1900): 14. **Fonseca.**

On the St. Paul Trail in the Sixties. By W. G. Fonseca. *With Illustrations.*

The writer describes his experiences as a pioneer on the Red river route from Fort Garry to St. Paul, Minnesota, before the founding of Winnipeg.

Geographical Names. *National G. Mag.* **11** (1900): 478–480. ———

Decisions of the U.S. Board on Geographic Names.

A list of decisions arrived at at the meeting of the board in October last. All have reference to places in the United States and Alaska.

Mexico—Mitla. **Corner.**

Mitla: an Archæological Study of the Ancient Ruins and Remains in that Pueblo. By William Corner. [Reprinted from the *Journal of the Anthropological Institute*, August and November, 1899.] London: Harrison & Sons, 1899. Size 11 × 7½, pp. [24]. *Plates.*

Mexico—Sierra Madre. **Ordoñez.**

Un voyage a la "Sierra Madre del Sur." Par M. Ezequiel Ordoñez. (Memorias de la Sociedad Cientifica "Antonio Alzate.") Mexico, 1899. Size 9 × 6½, pp. [16]. *Presented by the Author.*

Mexico—Trade. **Jerome.**

Trade of Mexico for the year 1899. Foreign Office, Annual No. 2527, 1900. Size 10 × 6½, pp. 48. *Price* 2½*d.*

It is a pleasant variation from the story so often told in consular reports to learn that in Mexico travellers for Manchester goods, which almost monopolize the market, show an activity worthy of emulation elsewhere. The chief trade centres in the interior are Merida for the south-east, Mexico city for the south-west, Monterey for the north-east, Guadalajara for the west, and Chihuahua and Guaymas for the north-west. A renewal of activity on the Pacific may be anticipated from the construction of the port of Salina Cruz. The sugar output in 1899 is estimated at 150,000 tons.

Mexico and Guatemala. *Globus* **78** (1900): 389–392. **Sapper.**

Cäcilie Seler auf alten Wegen in Mexiko und Guatemala. Von Karl Sapper. *With Illustrations.*

Review of Frau Seler's book noticed above, p. 192.

United States. ———

Annual Reports of the War Department for the fiscal year ended June 30, 1899. Report of the Chief of Engineers. 6 vols. Washington, 1899. Size 9½ × 6, pp. xxiv. and 3654. *Maps, Plans, and Illustrations. Presented by the Chief of Engineers, U.S. Army.*

United States—Arid Region. *B. American Bureau G.* **1** (1900): 221–233. **Redway.**

The Influence of Rainfall on Commercial Development: a study of the Arid Region. By J. W. Redway.

An instructive study of the influence of physical on human geography as shown by a special case.

United States—Colorado. **Pearce.**

Mining Industry of Colorado. Foreign Office, Miscellaneous, No. 532, 1900. Size 9½ × 6, pp. 14. *Price* 1*d.*

United States—Immigration. **Rossi.**

L'emigrazione Italiana agli Stati Uniti nell' anno 1899–1900. Rapporto del cav. Egisto Rossi. (B. Ministero degli Affari Esteri, Octobre 1900.) Roma, 1900. Size 9½ × 6½, pp. 22.

United States—Meteorology. ———

Tables of Daily Precipitation at special River and Rainfall Stations of the United States Weather Bureau for the years 1893, 1894, 1895. (U.S. Department of Agriculture, Weather Bureau.) Washington, 1900. Size 10 × 6½, pp. 256. *Presented by the U.S. Department of Agriculture, Weather Bureau.*

United States—Montana. *B. American Bureau G.* **1** (1900): 280–295. **Holzinger.**

Lake McDonald and Vicinity. By J. M. Holzinger. *With Illustrations.*

A sketch of the physical geography of the neighbourhood of Lake McDonald, from observations during a visit in 1898.

United States—Pacific Coast. *B. American Bureau G.* **1** (1900): 135–141. **Fairbanks.**

The Study of Physical Geography upon the Pacific Coast. By H. W. Fairbanks.

United States—Texas—Hurricane. *Monthly Weather Rev.* **28** (1900): 372–377. ———

Special report of the Galveston hurricane of September 8, 1900.

United States—Trade. **Hitchcock.**

Our Foreign Trade in Agricultural Products, 1894–1898. (1899, pp. 46.) Ditto 1890–1899. By Frank H. Hitchcock. (1900, pp. 62.) (U.S. Department of Agriculture. Section of Foreign Markets. Bulletin, Nos. 15 and 19.) Washington. Size 6 × 6. *Presented by the U.S. Department of Agriculture.*

United States—Virginia. **Thom.**

The Struggle for Religious Freedom in Virginia: the Baptists. By W. T. Thom. (Johns Hopkins University Studies in Historical and Political Science. Series xviii. Nos. 10–11–12.) Baltimore, 1900. Size 9½ × 6, pp. 106. *With Map.*

The map is a tracing from the Lewis map prefixed to Jefferson's Notes on Virginia (1794), and shows the distribution of Baptist churches in 1770 and 1774–76.

United States—Wyoming. *National G. Mag.* **11** (1900): 449–465. **Knight.**

The Wyoming Fossil Fields Expedition of July, 1899. By W. C. Knight. *Illustr.*

The expedition referred to had for its objective the Grand Cañon of the Platte, which, Mr. Knight says, had never previously been described. Some good illustrations of it accompany the paper.

CENTRAL AND SOUTH AMERICA.

Brazil—Amazonas. **Giglioli.**

Il "Cambarysú" telefono dei Catuquinarú dell' Amazzonia. Nota di Enrico H. Giglioli. (Estratto dall' *Archivio per l'Antropologia e l'Etnologia*, vol. xxviii., fasc. 3°, 1898.) Size 10 × 7, pp. 4. *Plan. Presented by the Author.*

On the Indian telegraph described in the *Journal* for July, 1898.

Brazil—Goyaz. **Negri.**

Lo Stato di Goyaz. Rapporto del cav. E. Negri dei conti di Lamporo. (B. Ministero Affari Esteri. August, 1900.) Roma, 1900. Size 9½ × 6½, pp. 18.

Notes on the State of Goyaz, its productions, financial position, etc.

Chile and Peru. **Salas-Edwards.**

The Liquidation of the War on the Pacific. By Ricardo Salas-Edwards. London, 1900. Size 9½ × 6, pp. 56. *Map.*

The writer reviews the circumstances which led to the war between Chile and Peru, and discusses the questions still pending between the two countries, especially the eventual ownership of Tacna and Arica.

Cuba—Census. ——

War Department, Office Director Census of Cuba. Report on the Census of Cuba, 1899. Washington, 1900. Size 9½ × 6, pp. 786. *Maps, Diagrams, and Illustrations. Presented by the United States Government.*

The full results of the recent census of Cuba, including valuable details on the present state of agriculture in Cuba, as well as on points more nearly related to the enumeration, such as the distribution, occupations, etc., of the population.

Dutch and French Guiana. **Pigott and Wacongne.**

Trade of Dutch and French Guiana for the year 1899. Foreign Office, Annual No. 2514, 1900. Size 10 × 6½, pp. 14. *Price* 1*d.*

The largest share in the import trade into Dutch Guiana is held by the Netherlands, and the next by the United States, while for exports the positions are reversed.

Haiti. *B. American Bureau G.* **1** (1900): 249–260. **Powell.**

Haiti. By W. F. Powell. *With Illustrations.*

Peru—Mythology. **Quevedo.**

Los Ojos de Imaymana y el Señor de la Ventana. Por S. A. Lafone Quevedo, M.A. Buenos Aires, 1900. Size 11 × 7½, pp. 32. *Illustrations.*

On some points of Peruvian mythology suggested by Molina's 'Rites and Laws of the Incas,' published in English by the Hakluyt Society in 1873.

Railway. *Petermanns M.* **46** (1900): 173–182. **Sievers.**

Die nord-südamerikanische Längsbahn. Von Prof. Dr. W. Sievers. *With Map.*

See note at p. 77, *supra.*

St. Kitts. *Monthly Weather Rev.* **28** (1900): 330–333. **Alexander.**

Climatology of St. Kitts, W.I. By W. S. Alexander.

Turks and Caicos Islands. **Cameron.**

Turks and Caicos Islands. Report for 1899. Colonial Reports, Annual No. 297, 1900. Size 9½ × 6, pp. 22. *Price* 1½*d.*

The export of salt in 1899 reached a total value of £21,138, and that of sisal grass, which continues to increase steadily, £7493. The sponge industry also shows signs of development. The principal steamers which touch at Grand Turk, apart from the monthly mail steamer from Halifax to Jamaica, belong to the United States.

AUSTRALASIA AND PACIFIC ISLANDS.

Fiji. **Vaughan.**

Fiji. Meteorological Observations taken at Suva during 1899. By J. D. W. Vaughan. Suva, 1900. Size 13½ × 8½, pp. 16.

New Zealand—Architecture. *J.R.I. Brit. Architects* 7 (1900): 481–491. **Seager.**
Architectural Art in New Zealand. By S. Hurst Seager. *With Illustrations.*

New Zealand—Statistics. ———
Statistics of the Colony of New Zealand for the year 1898. Wellington, 1899. Size 13½ × 8½, pp. xvi. and 540.

New Zealand—Year-Book. **Dadelszen.**
The New Zealand Official Year-Book, 1900. Prepared by E. J. von Dadelszen. Wellington; London: Eyre & Spottiswoode. 1900. Size 8½ × 5½, pp. vi. and 648. *Map and Illustrations. Presented by the Author.*

This useful handbook presents a large amount of information on all matters of public interest affecting the colony of New Zealand. A variety of special articles deal with such subjects as agriculture, mineral resources, industries, etc., and a detailed description is given of the separate "land districts."

Pacific Ocean—Soundings. **Somerville.**
Report on Sounding Cruise of H.M.S. *Egeria* (Commander Morris H. Smyth) on the Proposed Pacific Cable Route. By Lieutenant Boyle T. Somerville, R.N., N. Pacific Ocean, 1899. London: J. D. Potter, 1900. Size 13½ × 8½, pp. 12. *Chart. Price* 9*d. Presented by the Hydrographic Department, Admiralty.*

Queensland. **Berry.**
The Great Queensland Winter Pleasure Trip. By the Rev. Joseph Berry. (The *Review of Reviews for Australasia*, September, 1900, pp. 355–378.) Melbourne. Size 9½ × 7½. *Illustrations.*

Account of the voyage from Adelaide to Cairns, in North Queensland, with description of places visited.

Victoria. ———
Statistical Register of the Colony of Victoria, etc., 1897 and 1898. Melbourne. Size 13 × 8½.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Land Forms. *B. American Bureau G.* 1 (1900): 66–74. **Moore.**
Introduction to Physiography of Land Forms. By W. C. Moore.

Meteorology. **Bezold.**
Bericht über die Thätigkeit des Königlich Preussischen Meteorologischen Instituts im Jahre 1899. Von Wilhelm von Bezold. Berlin, 1900. Size 10 × 6½, pp. 36.

Meteorology. *C. Rd.* 131 (1900): 1298–1300. **Chauveau.**
Sur la variation diurne de l'électricité atmosphérique. Note de M. A. B. Chauveau.

Oceanography—Black Sea. *Scottish G. Mag.* 16 (1900): 673–702. **Murray.**
On the Deposits of the Black Sea. By Sir John Murray, K.C.B., etc. *With Map and Section.*

Before describing the deposit-samples collected in the Black sea during the Russian Explorations of 1890–91, the author gives a useful sketch of the general physical conditions of that sea.

Oceanography—Drift-ice. *Ymer* 20 (1900): 157–189. **Petterson.**
Our driftsen i Norra Atlanten. Af O. Pettersson. *With Diagrams.*

A summary of results of recent investigations on drift-ice in the North Atlantic.

Origin of Terms. *Nature* 63 (1900): 207–208. **[Gregory.]**
Physiography and Physical Geography. By R. A. G.

On the history and meaning of the terms. In the next number of *Nature*, Dr. Mill calls attention to the use of the term Physiography by Linnæus.

Physical Geography. **Dodge.**
A Reader in Physical Geography for beginners. By R. E. Dodge. London and Bombay: Longmans & Co., 1900. Size 8 × 5½, pp. x. and 238. *Maps and Illustrations. Presented by the Publishers.*

An instructive sketch, for the use of beginners, of the more important principles of Physical Geography, attention being also paid to the human and other life-conditions

dependent on them. It is meant rather to suggest lines of study than to supply details found in ordinary text-books. It is intended, of course, primarily for American readers, and the illustrations are mostly drawn from examples supplied by the United States.

Tide. *Nautical Mag.* **69** (1900): 756–773. **Moxly.**

The New Theory of Tide. By Rev. J. H. S. Moxly.

Reply to Mr. Plumstead's criticism of the theory (cf. *Journal*, vol. xiv. p. 123).

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Cabot's Landfall. **O'Brien.**

P. and T.R.S. Canada **5** (1899), (Sec. ii): 427–455.

Cabot's Landfall and Chart: some criticisms answered. By Most Rev. Archbishop O'Brien. *With Charts.*

An answer to Dr. Dawson's objections to the writer's theory, put forward in 1897.

Historical—Cão and Dias. **Ravenstein.**

The Voyages of Diogo Cão and Bartholomeu Dias, 1482–88. By E. G. Ravenstein. (From the *Geographical Journal* for December, 1900.) Size 10 × 6½, pp. 32. *Maps and Illustrations.*

GENERAL.

Colonization. **Noël.**

Quel est le régime économique qui favorise le plus la colonisation? Par M. Octave Noël. (Congrès International de Géographie économique et commerciale. Rapports sur les questions mises spécialement à l'étude. 4e section—Question i.) Paris: Société de Géographie commerciale. Size 10½ × 7, pp. 14.

Freedom of trade is held by the author to be one of the most powerful aids towards successful colonization.

Education. *B. American Bureau G.* **1** (1900): 271–274. **Brown.**

Geography work for Primary Children in City Schools. By E. R. Brown.

Education. *B. American Bureau G.* **1** (1900): 20–26. **Chamberlain.**

Geography as a Basis for Correlation. By J. F. Chamberlain.

Education. *B. American Bureau G.* **1** (1900): 32–43. **Holzinger.**

The Points of the Compass, and the Seasons, in Teaching Geography in the Grades. By J. M. Holzinger.

Education. *B. American Bureau G.* **1** (1900): 268–270. **Ireland.**

Geography as seen by the Child. By R. P. Ireland.

Education. *B. American Bureau G.* **1** (1900): 27–31, 123–134. **King.**

Concrete Geography. By C. F. King. *With Illustrations.*

The writer urges the importance of giving reality to the teaching of geography by vivid description, aided by maps and pictures. He takes the Hudson river as an object-lesson.

Education. **Levasseur.**

Trente-deux ans d'enseignement au Collège de France. Chaire de Géographie, Histoire et Statistique économique. Par E. Levasseur. (Extrait de la Revue Internationale de l'Enseignement.) Paris: A. Chevalier-Maresecq & Cie, 1900. Size 10 × 6½, pp. 22.

A summary of the work done in geography and allied subjects during M. Levasseur's tenure of the professorship at the "Collège de France."

Education. *B. American Bureau G.* **1** (1900): 11–19. **McCormick.**

What to Teach in Geography. By Henry McCormick.

Education. *B. American Bureau G.* **1** (1900): 5–10. **Miller.**

Educational Value of Geographical Study. By Elmer I. Miller.

Education. *B. American Bureau G.* **1** (1900): 111–122. **Miller.**

Organic Geography. By Louise Miller.

On geography viewed as the study of the "unity and organic inter-relationships of the physical earth."

Education. *B. American Bureau G.* 1 (1900): 209-219. **Rowe.**
Geography made attractive. By Mary E. Rowe.

Education—Astronomy. *B. American Bureau G.* 1 (1900): 265-268. **Reclus-Guyou.**
A School Orrery. By G. P. Reclus-Guyou.

Education—Bibliography. *B. American Bureau G.* 1 (1900): 157-163. **Chamberlain.**
A List of Books, Reports, and Articles dealing with the Teaching of Geography. By J. F. Chamberlain.

Education—Map-drawing. *B. American Bureau G.* 1 (1900): 99-103. **Goode.**
Free-hand Map Work. By J. P. Goode.

The writer insists on the importance of map-drawing from an educational point of view.

Education—Methods. **Dubois.**
Des meilleures méthodes et des moyens pratiques d'enseignement de la Géographie économique. Par M. Marcel Dubois. (Congrès International de Géographie économique et commerciale. Rapports sur les questions mises spécialement à l'étude. 4e Section—Question i.) Paris: Société de Géographie commerciale. Size 10½ × 7, pp. 10.

Education—Methods. *B. American Bureau G.* 1 (1900): 260-264. **Holway.**
Modeling Mount Shasta. By R. S. Holway. *With Illustrations.*

On practical work done by a physical geography class.

Education—Methods. *B. American Bureau G.* 1 (1900): 105-111. **Johnson.**
Method in Geography. By Willis E. Johnson.

Education—Methods. **Overton.**
A Practical Method of Teaching Geography. By J. H. Overton. (England and Wales); Book 2 (Europe). London: Cassell & Co., 1899. Size 7½ × 11. *Price (each)* 6*d*. *Presented by the Publishers.*

The method consists in causing the pupils to trace in succession (from the outline maps supplied) the various physical and other features of the country studied, naming them at first from the copy, afterwards from memory. The exercises will, no doubt, prove of considerable value, though some doubt may be entertained as to the wisdom of the substitution of tracing for freehand drawing. The author takes up in this respect a position diametrically opposed to that of Mr. Goode in the article noticed above, the latter maintaining that map-drawing by eye is within the reach of all, and a most important aid to the learning of geography.

Education—Physical Geography. *National G. Mag.* 11 (1900): 470-475. **Dodge.**
The Teaching of Physical Geography in Elementary Schools. By Richard E. Dodge.

The writer urges the importance of the teaching of physical geography in elementary schools, not as an end in itself, but as a means to an end.

Education—Physiography. *B. American Bureau G.* 1 (1900): 43-50. **Collie.**
Physiography in the Schools. By G. L. Collie.

Education—Physiography. *B. American Bureau G.* 1 (1900): 60-66. **Kümmel.**
Laboratory Work in Physiography. By H. B. Kümmel.

Education—Physiography. *B. American Bureau G.* 1 (1900): 50-60. **Tarr.**
The Use of Physiography in Geography Study. By Ralph S. Tarr.

Elephants. *B.S. d'Études Colon.* 7 (1900): 825. **Carton.**
Note sur l'utilisation rationnelle de l'éléphant. Par J. Carton. *With Illustrations.*

One of the writer's suggestions is that the tusks of domesticated elephants should be sawn off square and fitted with various implements suited to the special task in hand.

Ethnology. **Giglioli.**
La Etnologia all' Esposizione di Torino nel 1898. Appunti del Prof. Enrico H. Giglioli. (Estratto dall' *Archivio per l'Antropologia e l'Etnologia*, vol. xxix. fasc. 1°, 1899.) Size 10 × 7, pp. 16. *Presented by the Author.*

Exploration. **Claparède.**
Revue sommaire des principales explorations de l'année 1900. Par Arthur de Claparède. Genève, 1900. Size 7½ × 5, pp. 36. *Presented by the Author.*

German Colonies.

Kolonial-Handels-Adressbuch 1901 (5. Jahrgang) (Beilage zum "Deutschen Kolonialblatt," xii. Jahrgang), Herausgegeben von dem Kolonial-Wirtschaftlichen Komitee. Berlin. Size 10 × 7, pp. 184. *Maps.*

Contains a good deal of statistical and other information on the German colonies.

German Hydrographic Office.

Zweiundzwanzigster Jahresbericht über die Thätigkeit der Deutschen Seewarte für das Jahr 1899. Erstattet von der Direktion. Beiheft ii. zu den "Annalen der Hydrographie und Maritimen Meteorologie," 1900. Hamburg, 1900. Size 10½ × 7½, pp. iv. and 104.

Imperial Federation. *Fortnightly Rev.* **68** (1900): 1009-1019. **Salmon.**

Imperial Federation: the Condition of Progress. By Edward Salmon.

Malaria. *J.S. Arts* **49** (1900): 18-26. **Ross.**

Malaria and Mosquitoes. By Major R. Ross.

Malarial Infection. **Christophers and Stephens.**

The Native as the Prime Agent in the Malarial Infection of Europeans. With Map. (Further Reports to the Malaria Committee of the Royal Society. By S. R. Christophers, M.B., and J. W. W. Stephens, M.D. Pp. 3-19.) London: Harrison & Sons, 1900. Size 8½ × 5½.

The influence of the native in the spread of malaria is shown both in the breeding-places of the Anopheles mosquito supplied in the neighbourhood of native dwellings, and in the shelter afforded to the mosquitoes by such dwellings in the absence of breeding-grounds.

Measures of Time, Space, Etc. **Schumacher.**

XVII. Jahresb. G. Ges. Bern (1898-99): 95-119.

Die Uebereinstimmung von Zeit, Weg und Kreisteilung. Von A. Schumacher.

The writer advocates a uniform system of division for time, distance, and the circle.

Scurvy. **Wright.**

On the Pathology and Therapeutics of Scurvy. By A. E. Wright, M.D. (Reprinted from the *Lancet*, August 25, 1900.) Size 7½ × 5, pp. 8. *Presented by the Author.*

Telegraphs. *J.R. United Service I.* **44** (1900): 1381-1407. **Bellairs.**

The Routes of Submarine Cables. By Lieut. C. W. Bellairs.

The writer discusses the principles which should determine the choice of cable routes, holding that the single aim should be the assisting of commerce. He condemns the all-British Pacific Scheme as expensive and exposed to more risk than one following a natural route through neutral territory.

Weights and Measures, Etc.

Conversion Tables of Weights and Measures and Foreign Moneys. Prepared by the Philadelphia Commercial Museum. Philadelphia, 1900. Size 8½ × 4, pp. 32. *Presented by the Museum.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales: Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1901.

1-inch—General Map:—

England and Wales (revision):—with hills in brown or black, 132, 140, 214, 228 (engraved). 1*s. each.*

England and Wales (revision):—printed in colours, 1, 2, 5, 6, 7. 1*s. each.*

6-inch—County Maps:—

England and Wales (revision):—**Anglesey**, 1 S.E., 3 N.W., N.E., 5 N.E., 6 N.W., S.W., 7 N.W., N.E., 8 S.W., 11 N.E., S.W., 12 N.W., N.E., S.W., S.E., 13 N.W., N.E., S.W., S.E., 14 S.W., S.E., 16 (N.W. and N.E.), 17 N.W., N.E., S.W., S.E., 18 N.W., N.E., S.W., S.E., 19 N.W., N.E., 21 N.W., N.E., 22 S.E., 23 N.W., 25 N.W. **Carnarvonshire**, 2 S.W., 3 S.E., 6 N.E., 8 N.E., 9 S.W., 10 S.E., 11 N.W., 12 N.E., 13 S.W., 14 N.W., S.W., 15 N.W., 18 S.W., S.E., 23 N.E., S.E., 24 N.W., S.W., 30 N.E., 33 N.W., N.E. **Cumberland**, 21 N.W., 33 NW.,

35 N.E., 36 S.W., 39 N.E. **Denbighshire,** 3 S.W., 11 N.W., 16 N.W., 23 N.W. **Derbyshire,** 45 S.E. **Glamorganshire,** 7 N.W., 11 S.E., 27 N.E., 36 N.E., 37 S.W., 51 N.E. **Northamptonshire,** 29 S.E., 32 N.E., S.E., 33 S.E., 36 N.E., S.W., 40 N.E., 44 N.W., 50 N.E., 52 N.E., 55 N.E., 59 N.E. **Nottinghamshire,** 33 S.W., 34 N.E., 43 S.W. **Staffordshire,** 18 S.W. **Wiltshire,** 21 S.E., 22 N.W., 25 N.E., 26 S.E., 27 S.W., 28 N.E., 35 N.W., 36 N.W., 41 S.W., 42 N.W. 1*s. each.*

25-inch—Parish **Maps:**—

ENGLAND AND WALES (revision):—**Bedfordshire,** XXII. 14; XXIV. 16; XXV. 10, 12, 13, 14, 15, 16; XXVI. 1, 13, 15; XXVIII. 3, 14, 15, 16; XXIX. 1, 2, 3, 4, 13, 14, 15, 16; XXX. 1, 2, 5, 6, 9, 10, 13, 14; XXXI. 2, 3, 4, 7, 8, 12; XXXII. 1, 5, 6, 10, 12, 13, 16; XXXIII. 2, 3, 7, 9, 10, 11, 14, 15; XXXIV. 1, 2, 3, 5, 11; XXXV. 2, 3. **Carnarvonshire,** XXIX. 5; XLV. 13; XLVI. 5, 13. **Cumberland,** III. 6, 9, 10, 13, 14; VII. 1, 2, 4; IXA. 12; X. 8, 9, 10, 11, 12, 13, 14, 15, 16; XI. 7, 9, 11, 12, 13, 14, 16; XVI. 1, 2, 3, 4, 5, 6, 8, 9, 11; XVII. 1, 2, 3, 4, 5, 6, 9, 12, 15, 16; XXII. 5. **Derbyshire,** XLVI. 13; XLVII. 3, 4, 6, 10, 11, 12, 14, 15, 16; XLVIII. 1, 5, 10, 13, 14, 15, 16; LV. 3, 5, 6, 7, 8, 9, 12, 14, 16; LVI. 3. **Glamorganshire,** XIII. 14; XX. 6; XXXVII. 4; XLIII. 3, 6, 9, 12, 13, 14; XLVII. 2, 4. **Merionethshire,** IV. 5, 9, 13; VII. 3, 7, 11, 16; VIII. 5, 6, 10 (11 and 12), 15; XI. 7, 8, 10, 14, 16; XIII. 16; XIV. 3, 8, 9, 10, 12, 13, 16; XV. 1, 4, 6, 7, 9, 10, 11, 14; XVI. 3, 5, 7; XIX. 6, 7, 15; XX. 4, 8, 12; XXI. 4, 6, 8, 10, 11, 12, 15; XXII. 1, 5; XXIII. 2, 4, 7; XXV. 4, 8; XXVI. 1, 2, 5, 10, 11; XXVII. 4, 6, 7, 8, 10, 11, 12; XXVIII. 1, 5. **Monmouthshire,** I. 5; III. 8, 12, 14, 15, 16; IV. 1, 3, 5; XVII. 10, 14; XXII. 6; XXXII. 4; XXXVII. 12; XXXVIII. 5. **Northamptonshire,** IV. 13; V. 12; VII. 4; VIII. 3, 14; IX. 9; XII. 2; XLV. 1, 5, 6, 10, 14. **Nottinghamshire,** XXXVIII. 14; XLI. 16; XLII. 12; XLV. 3. **Staffordshire,** XXVI. 3, 6, 10, 14, 15. **Wiltshire,** XXXI. 12 (16 and 15 and XXXVIIIA. 4); XXXII. 1; XXXVIII. 1, 4, 5, 6, 12, 13; XXXVIIIA. 4 on XXXI. 16; XXXIX. 8, 9; XL. 7; LI. 5, 9, 11; LIII. 14, 15, 16; LIV. 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15; LV. 1, 10, 15; LIX. 2, 3, 4, 6, 7, 8, 10, 13, 14, 15; LX. 1, 2, 3, 4, 5, 7, 8, 9, 10, 13; LXI. 1, 2, 3, 5, 6, 7, 9, 10; LXV. 2, 3, 7, 11, 14, 15; LXX. 2, 6, 11. 3*s. each.*

(*E. Stanford, London Agent.*)

France. **Thoulet.**

Cartes Lithologiques des Côtes de France, par M. Thoulet. Professeur à la Faculté des Sciences de Nancy et à l'Ecole Supérieure de Marine. Paris: A. Challamel. 7 sheets. *Presented by the Author.*

The interesting results of Prof. Thoulet's investigations concerning the submarine lithology of the north coast of France from the Belgian frontier to the Channel islands are clearly shown on these seven charts, which, however, only represent a part of the work which he has completed. The outline and soundings are according to the charts of the "Service Hydrographique de la Marine," and upon these as a basis Prof. Thoulet has shown, by a series of tints and symbols, a vast amount of information concerning the various rocks forming the bed of the sea for a considerable distance beyond the coast-line, extending, in the case of the chart of the strait of Dover, across to the English coast, which is followed from Dover to the entrance to the Thames. On some of the charts there are altogether fourteen different colours and symbols employed, and there is abundant evidence of the very complete and painstaking manner in which the work has been performed. Contour-lines, showing depths of 10, 50, and 100 metres, are shown in bold lines, whilst others are laid down in dotted lines. Prof. Thoulet's work will prove most important to all interested in geology and physical geography.

ASIA.

China. **Koch and Friquegnon.**

Carte de la Cochinchine Française. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Par le Commandant A. Koch. Nouvelle édition, revue et mise à jour d'après les travaux du Service géographique de l'Indo Chine, du Service du Cadastre de la Cochinchine et du Lieutenant Oum. Par le Commandant Friquegnon. Paris: A. Challamel, 1901. 4 sheets.

The first edition of this map was published in 1889, since which date fresh information has been obtained, which is now shown in the new edition. The map is artistically printed in colours, but it is occasionally difficult to distinguish districts which are merely roughly sketched in from those more or less accurately surveyed.

AFRICA.

East Africa. **Hermann, Kohlschütter, and Glauning.**

Deutsch-englische Nyassa-Tanganyika-Grenzexpedition. Scale 1 : 100,000 or

1·6 stat. mile to an inch. Aufnahmen der deutschen Mitglieder Hauptmann Hermann, Dr. Kohlschütter, und Oberleutnant Glauning. Mitteilungen aus den deutschen Schutzgebieten. Band iii., 1900. Berlin: D. Reimer (Ernst Vohsen), 1900. 4 sheets.

This is a large-scale map, in four sheets, of the Anglo-German boundary-line between Lakes Nyasa and Tanganyika and the adjacent country, based upon the surveys made in 1898 by the German Commissioners for the delimitation of the boundary. A general account of the survey work of the British Commissioners, under the superintendence of Captain C. F. Close, R.E., was given in the *Geographical Journal* for June, 1899, accompanied by reduced maps; but this map is on a much larger scale (1: 100,000), and gives additional detailed information, especially on the German side of the boundary-line. It has evidently been carefully produced, and is printed in colours, the hillwork being shown by a system of brown horizontal lines. There is a full explanation of the signs employed, and an inset map is given showing the main triangulation. The map is accompanied by an account of the geodetic work of the commissioners, and the astronomical observations taken to fix positions.

West Africa. **Feist.**

Carte de la Côte Occidentale d'Afrique. Scale 1: 1,500,000 or 24 stat. miles to an inch. Dressée par le Lieut. Feist de l'Infanterie de Marine. Service Géographique des Colonies, Paris, 1900.

The recent explorations and surveys of French officers and others in West Africa, together with the rearrangement of districts, have rendered a new map of French West Africa very desirable, and it is, doubtless, to meet this need that this map is being published. The present sheet includes the region from the Senegal on the north to Liberia on the south, and from the coast on the west to long. 10° 40′ W. on the east.

AMERICA.

New Brunswick. **Ganong.**

Map of the Negoot or South Tobique Lakes. Scale 1: 126,720 or 2 stat. miles to an inch. Compiled by W. F. Ganong from Garden's and McInnes' Surveys and New observations. Natural History Society of New Brunswick, St. John, N.B. *Presented by the Natural History Society of New Brunswick.*

A very rough production, but shows some altitudes and soundings, which are interesting in connection with the drainage system of these lakes.

AUSTRALIA.

South Australia. **Brown.**

Geological Map of South Australia. Scale 1: 1,000,000 or 15·8 stat. miles to an inch. By H. Y. L. Brown, F.G.S., Government Geologist. Surveyor-General's Office, Adelaide, 1899. 4 sheets. *Presented by W. H. Duncan, Esq.*

In addition to a full explanation of the colours and symbols employed in this map, a list of the fossils peculiar to each formation is given, and in connection with the lower cretaceous formation there is an interesting table of the artesian wells which have been bored through it, giving their locality, depths, temperature of water, supply of water per diem, depths at which water was struck, etc.

This map does not include the Northern Territory of South Australia.

South Australia. **Brown and Winnecke.**

Geological Map of the Northern Territory of South Australia. Scale 1: 1,267,200 or 20 stat. miles to an inch. By H. Y. L. Brown, F.G.S. Physical Geography by C. Winnecke, F.R.G.S. Surveyor-General's Office, Adelaide. *Presented by W. H. Duncan, Esq.*

The data for compiling a geological map of the Northern Territory of South Australia is very meagre, but Mr. Brown has evidently made use of all the information that was available. The topographical features of the map have been compiled by Mr. C. Winnecke from private and official records.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for January, 1901. Specimen sheet. Meteorological Office, London, 1901. *Price 6d.*

Following the example set by the United States Hydrographic Department, the Meteorological Office have now arranged to publish a monthly pilot chart of the North Atlantic, which, however, is to include the Mediterranean as well. Although on a somewhat smaller scale, and differing considerably in detail, it is in many respects,

similar to that published in the United States. All information relating to atmospheric phenomena is given in black, while that connected with the sea is shown in blue. The most prevalent, and some of the least frequent winds, in ocean spaces of 5° of latitude by 5° of longitude, are shown by means of wind-roses on a circle at the centre of each space, and the average force of the wind is indicated. The percentage of calms and variable airs is also shown. Curved lines interrupted at short intervals are used to indicate the northern and southern limits of the North-East Trade Wind and the northern limit of the South-East Trade Wind; whilst a curved line, interrupted at long intervals, serves to show the average southern limit of the region in which gales exceed ten per cent. of the wind observations. Steamer and sailing routes are also shown, and the normal path followed by the centres of cyclonic systems is indicated by a double line, representing the line of mean positions of centres of cyclonic areas. Ocean currents are shown by waved arrows in blue, the length of which are approximately in proportion to the amount of current, whilst the maximum and minimum amount of set for twenty-four hours is indicated by figures.

In addition to the information here referred to, there are two isobaric charts, as insets, of the neighbourhood of the British Isles, and an inset of the North Atlantic ocean showing mean isobaric and isothermic lines for the month, and copious notes are printed upon the face of the chart. Unlike the United States chart, curves of equal magnetic variation are not laid down, and the important subject of magnetism and variation of the compass has, for some reason or other, been altogether omitted.

The various publications of the Hydrographic and Meteorological Offices, together with those of the United States Hydrographic Department, the Deutsche Seewarte, and the Meteorological Institutes of the Netherlands and Denmark, will be utilized monthly in the compilation of this chart, which will be supplied gratis to those captains and officers of the mercantile marine who are on the list of observers for the Meteorological Office, and copies will be obtainable by others at the price of 6*d*. each. Subscribers will be supplied with a complete set for a year at a cost of 5*s*.

Russian Charts. **Chief Hydrographic Department, St. Petersburg.**

The White and Arctic Seas.

No.

551. Plans of St. Lawrence bay, Karaginski island, Providence bay, Plover harbour, etc., Bering sea. 1900.
555. Bear island, with plan of South harbour, Barent sea. Scale 8400 feet to an inch. 1900.
553. Plan of Lapaminskaia harbour, White sea. Scale 700 feet to an inch. 1900.
552. Plan of Pavlakulskoi harbour, White sea. Scale 140 feet to an inch. 1900.

Black Sea.

559. Plans of the roadsteads of Sotcha and Khosta. Scale 1400 feet to an inch. 1900.
1811. From the Crimea to the mouths of the Danube. Scale 6·6 geo. miles to an inch. 1900.

North Pacific Ocean.

560. Chart of Anadyr bay. Scale 2·5 geo. miles to an inch. 1900.
549. Plans of the Kuril islands. 1900.
1816. Plan of America bay. Scale 2800 feet to an inch. 1900.
1829. Plan of Vostok bay. Scale 1400 feet to an inch. 1900.
1815. Cape Gamova to Yankovsk peninsula. Scale 4550 feet to an inch. 1900.
562. Port Arthur and southern part of Liao-Tung peninsula. Scale 5 geo. miles to an inch. 1900.

United States Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for March, 1901. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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Goajira
Santa Marta
R. Magdalena
Pto Colombia
Cartagena
Puerto Cabello
La Guayra
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Cumaná
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COSTA RICA
Isthmus of Panama
Lago de Maracaibo
R. Orinoco
VENEZUELA
Venezuelan Guiana
R. Casanare
Buenaventura
COLOMBIA
B. de Tumaco
Esmeraldas
Galapagos Is
QUITO
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ECUADOR
Golfo de Guayaquil
Rio Negro
R. Yapurá
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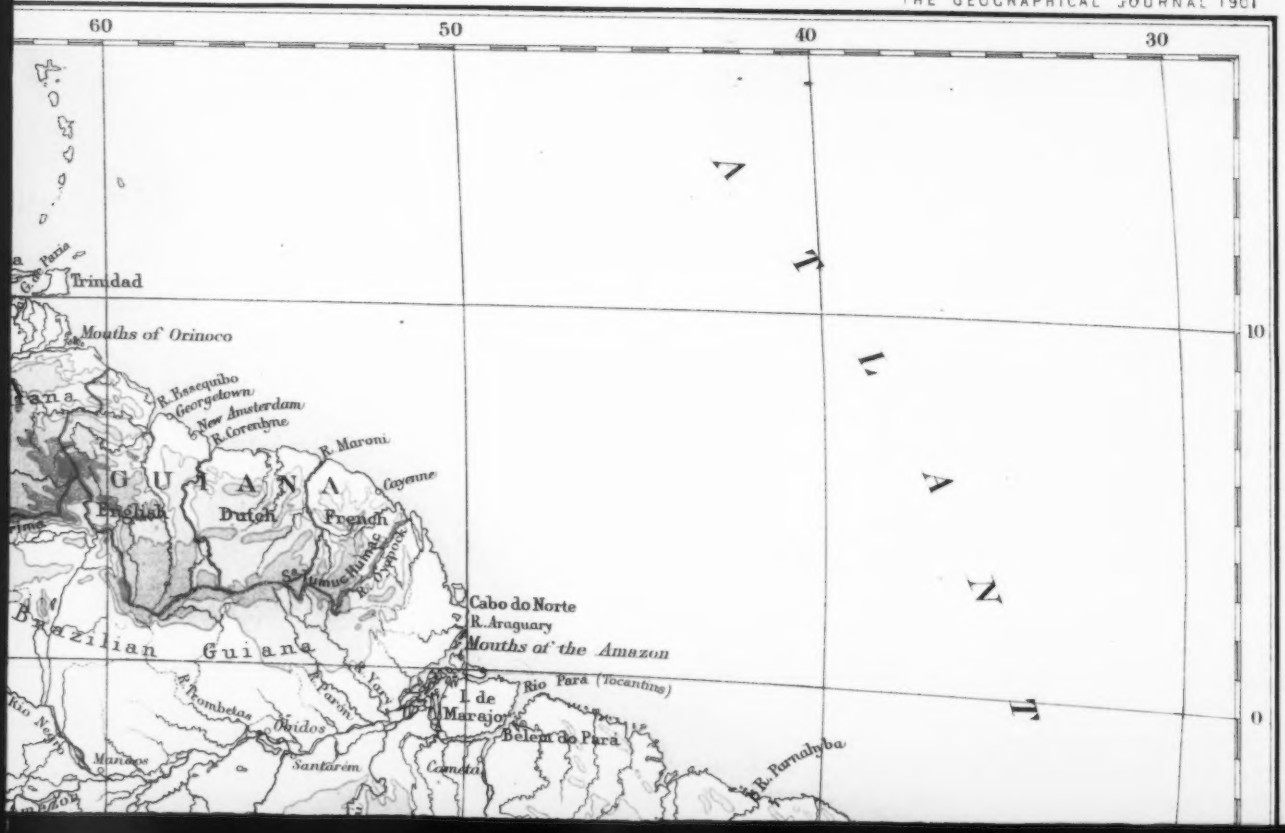
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Brazilian Guiana
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Mouths of the Amazon
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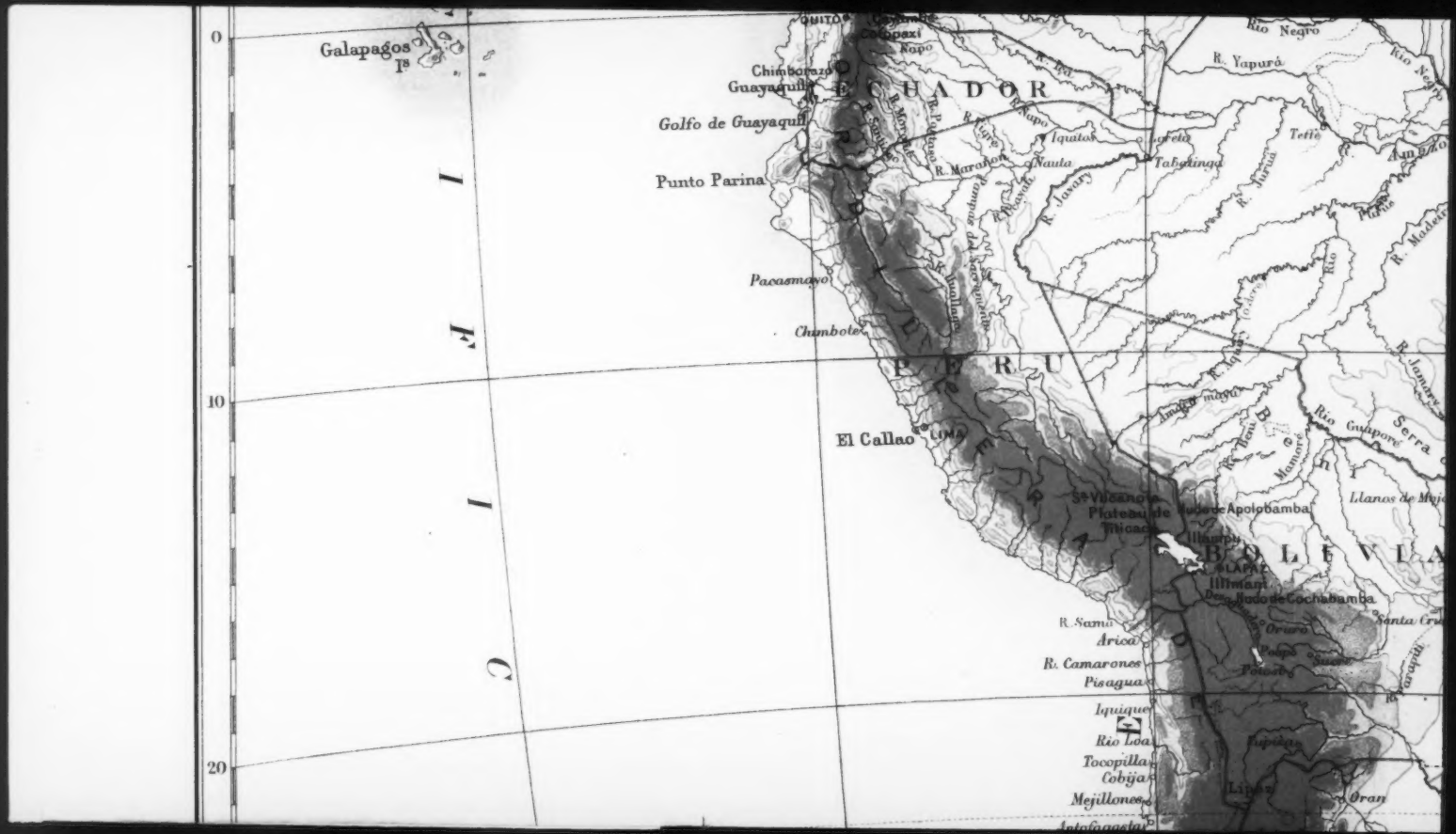
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Nauta
Tabatinga
Tefé
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R. Juruá
R. Madeira
Rio Guaporé
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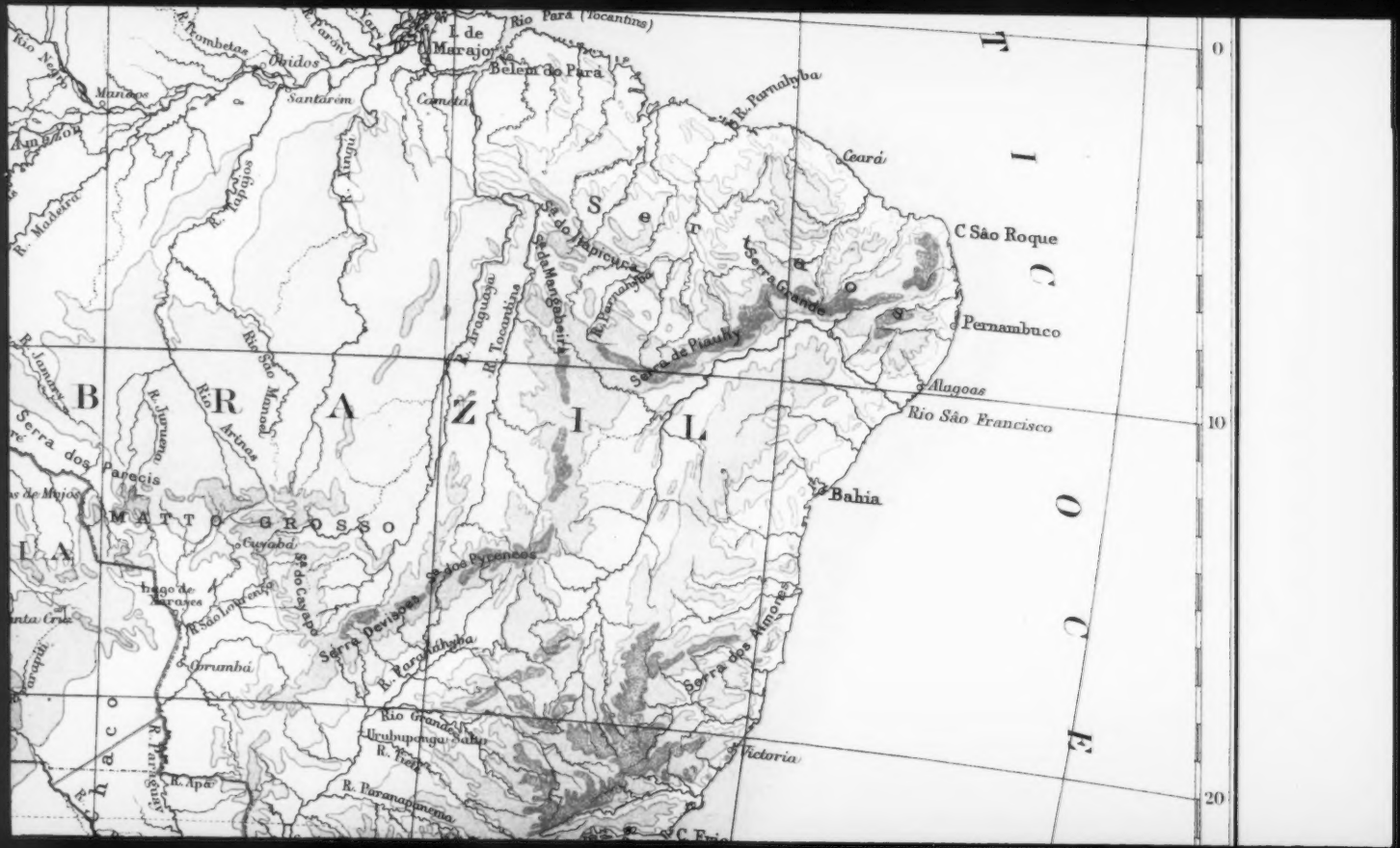
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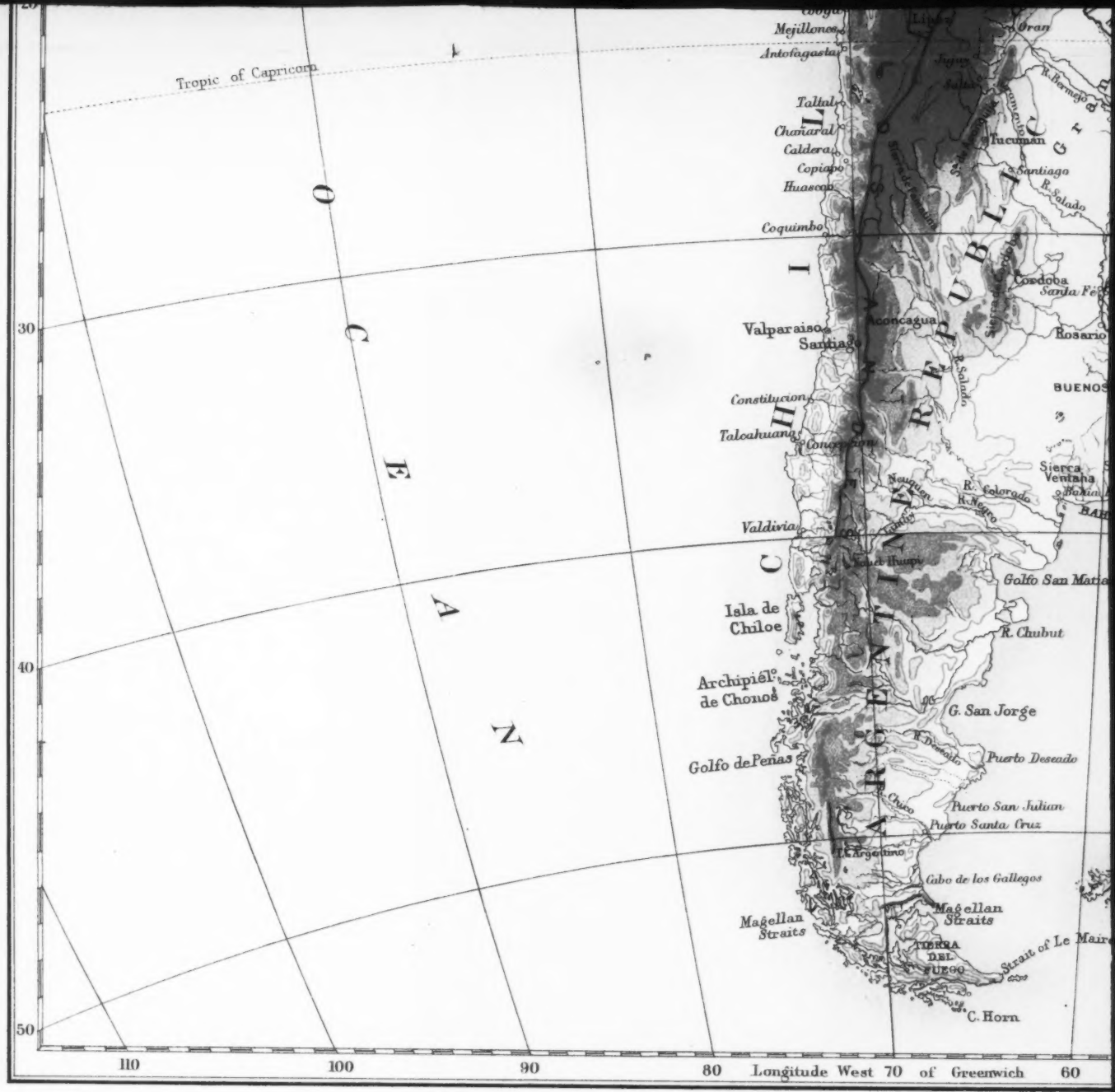

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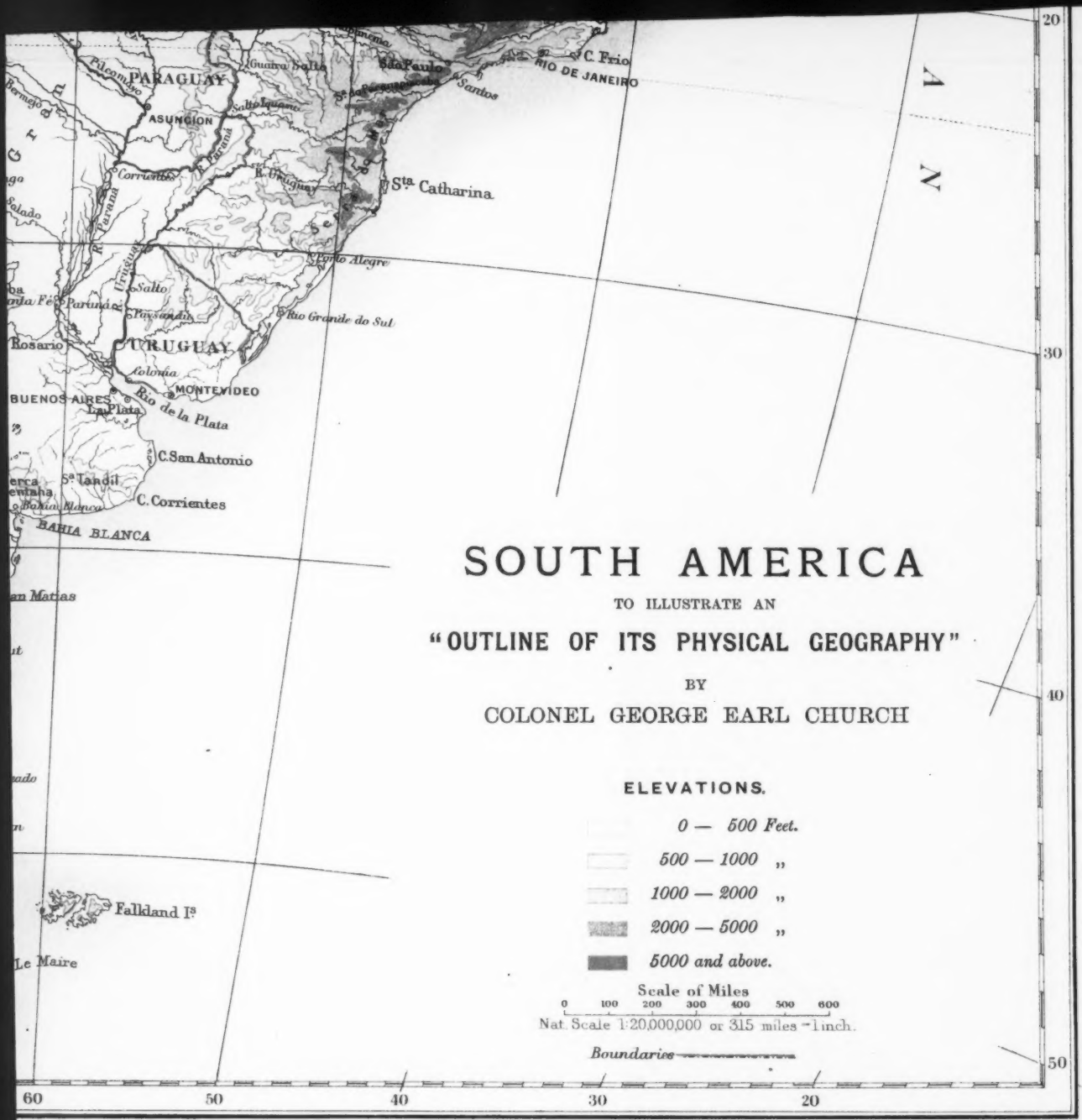


SOUTH AMERICA

TO ILLUSTRATE AN

"OUTLINE OF ITS PHYSICAL GEOGRAPHY"

BY

COLONEL GEORGE EARL CHURCH

ELEVATIONS.

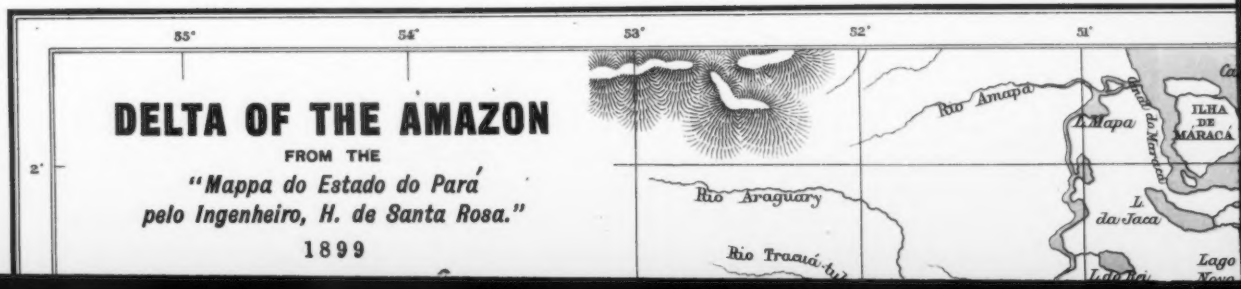
0 — 500 Feet.
500 — 1000 „
1000 — 2000 „
2000 — 5000 „
5000 and above.

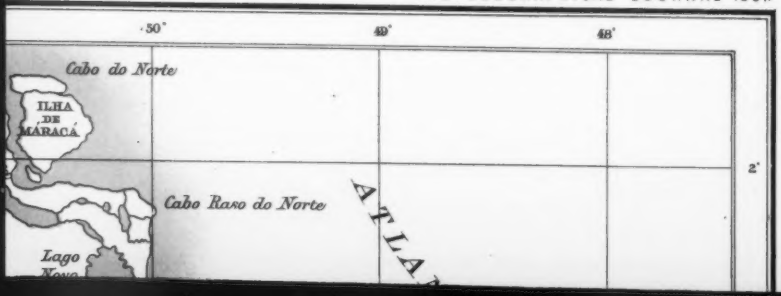
Scale of Miles
0 100 200 300 400 500 600
Nat. Scale 1:20,000,000 or 315 miles = 1 inch.

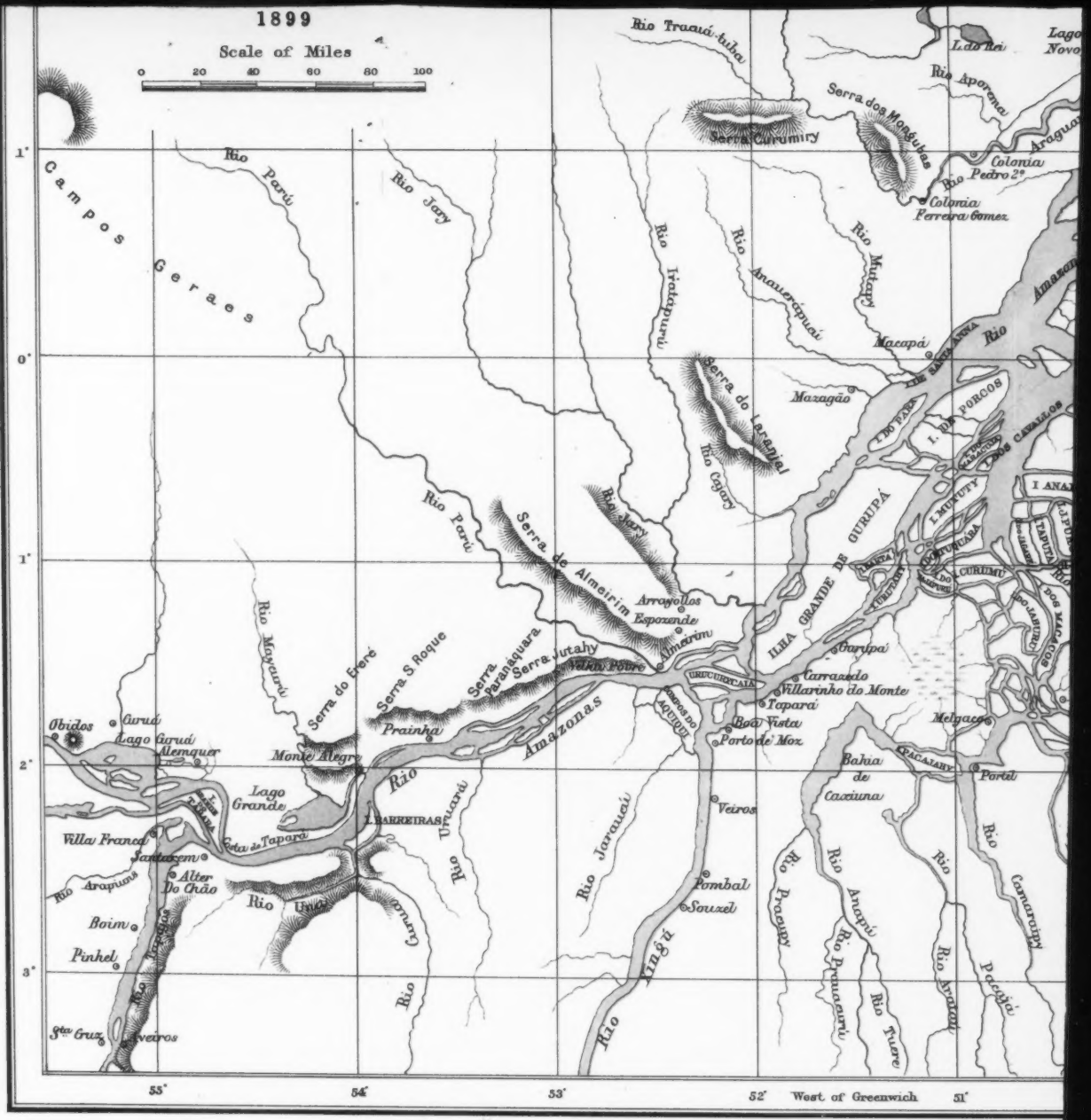
Boundaries

Geographical Society

W. & A. K. Johnston, Limited, Edinburgh & London


55°
54°
53°
52°
51°
DELTA OF THE AMAZON
FROM THE
"Mappa do Estado do Pará
pelo Ingenheiro, H. de Santa Rosa."
1899
2°
Rio Amapá
L. Mapa
ILHA
DE
MARACÁ
Rio Araguary
L.
da Jaca
Rio Tracuá-by
Lago


50°
49°
48°
Cabo do Norte
ILHA DE MARACÁ
Cabo Raso do Norte
2°
ATLA
Lago



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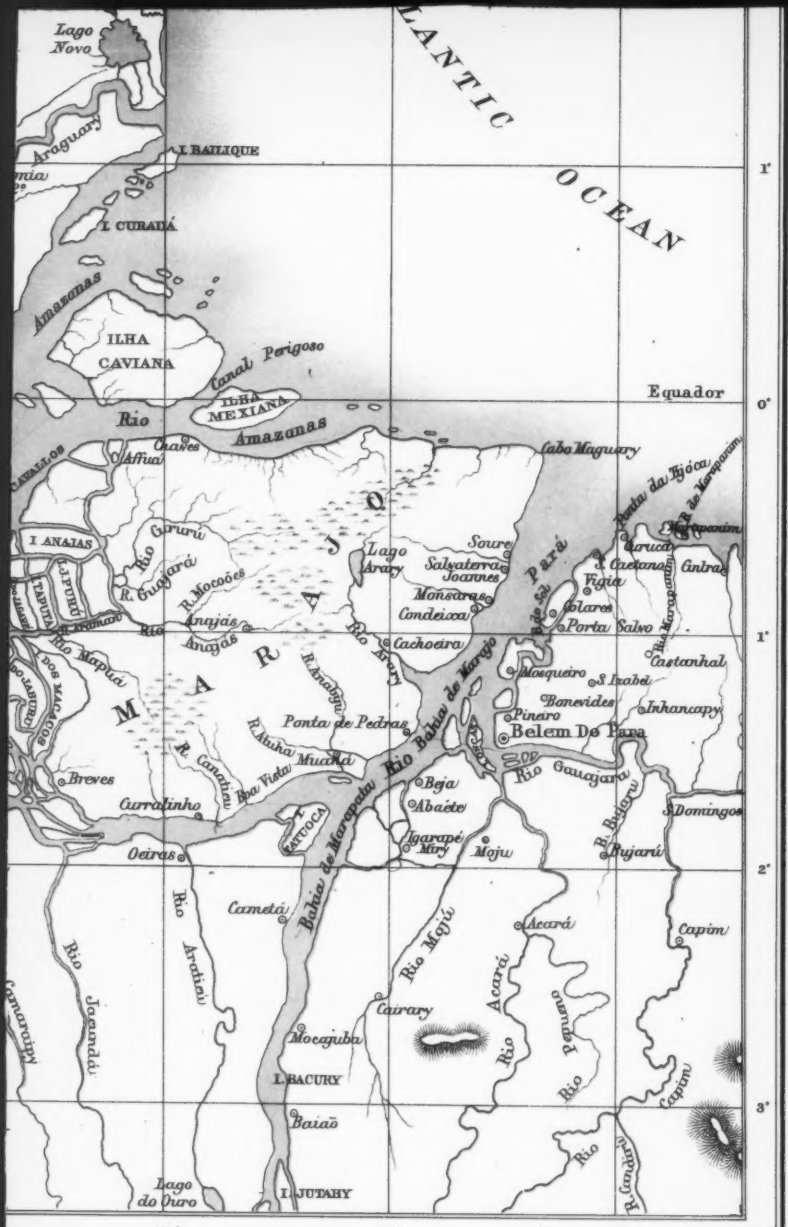

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DELTA OF THE RIO PARANÁ

REPUBLICA ORIENTAL DEL URUGUAY

Y

DELTA OF THE RIO PARANÁ

FROM SURVEYS BY THE STAFF ENGINEERS

OF THE DEPARTMENT OF PUBLIC WORKS

ARGENTINE REPUBLIC

1901.

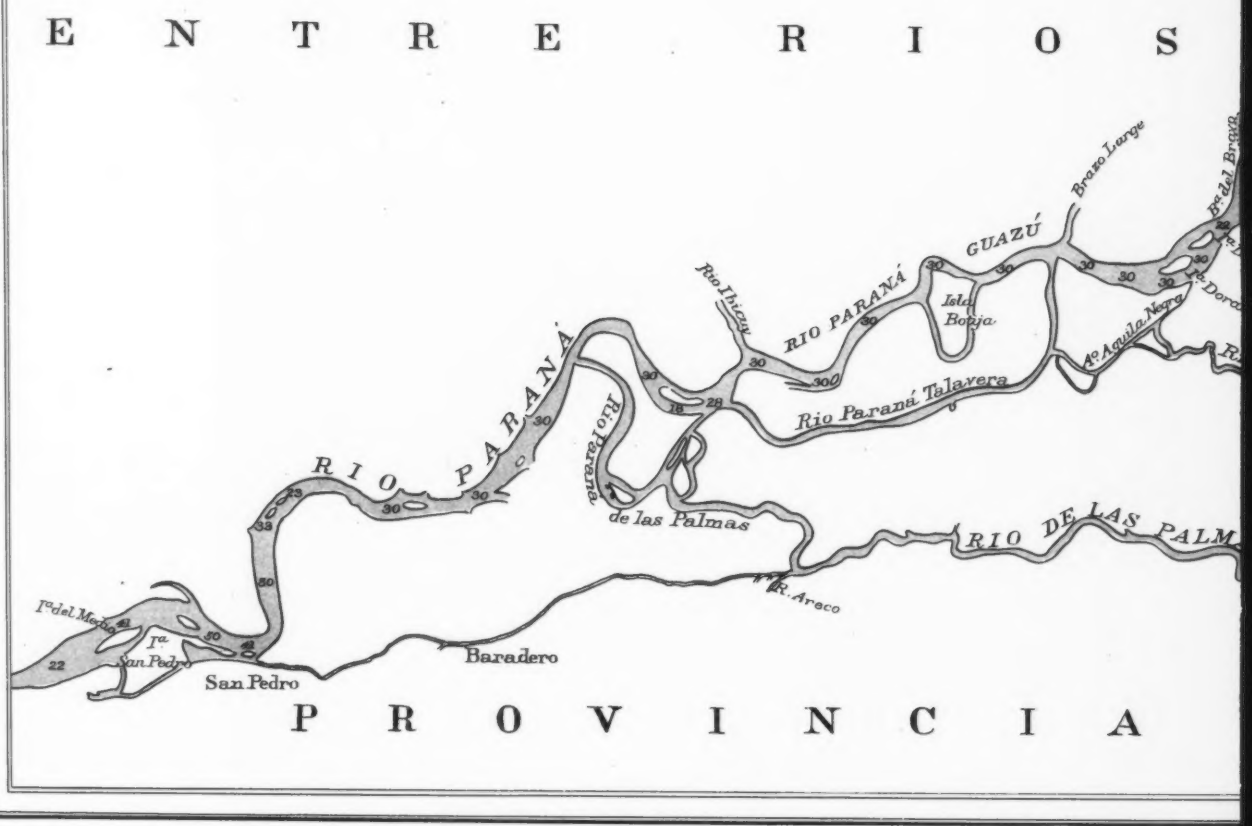
Scale of Miles

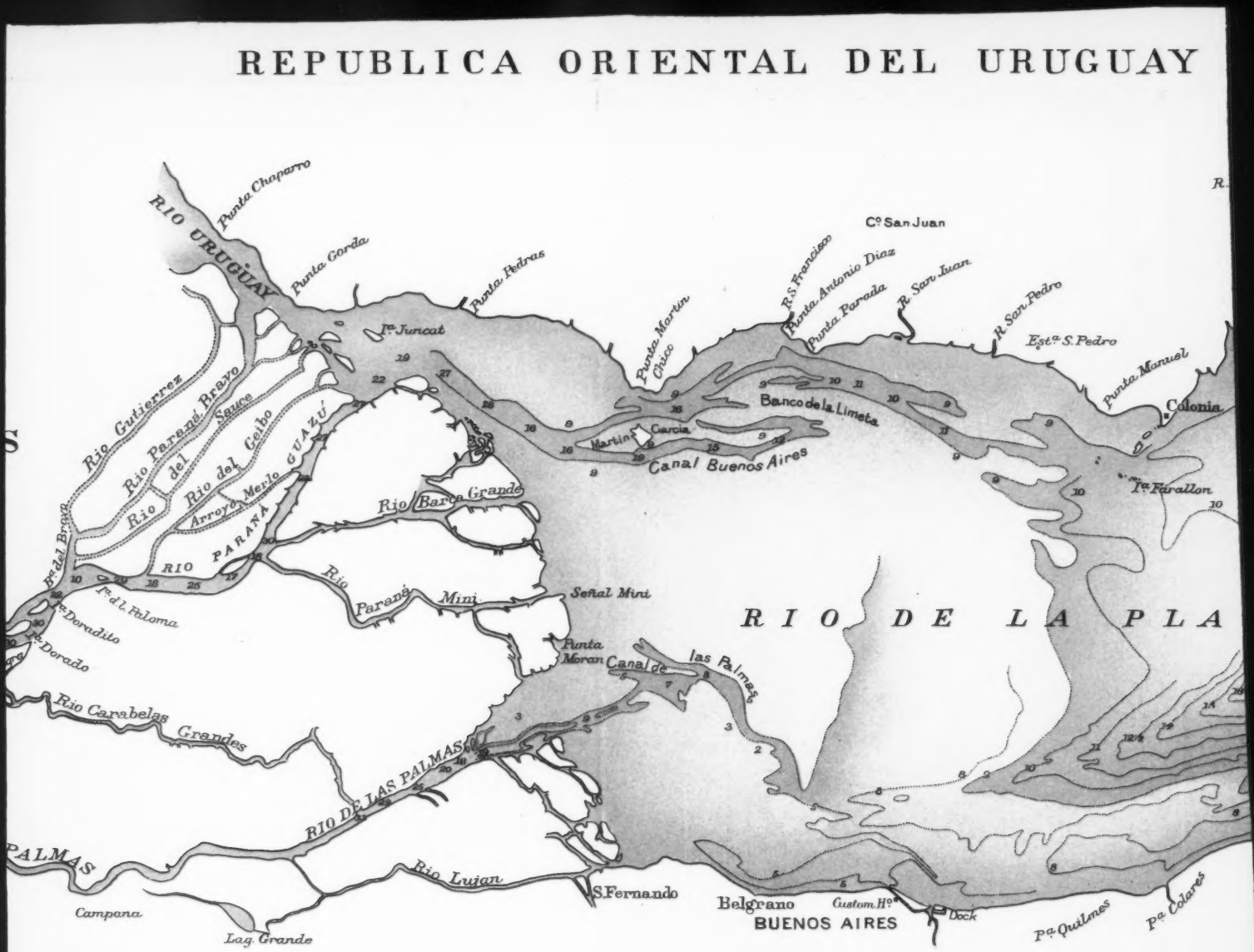
0 5 10 20 30

Nat. scale 1:500,000 or 7·89 miles = 1 inch.

Depths in Fathoms

Buenos Aires, Custom House Lat. 34° 36·5′ S. Lon. 58° 22·2 W.





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